

TROPICAL STORAGE ABSTRACTS.

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Tropical storage abstracts

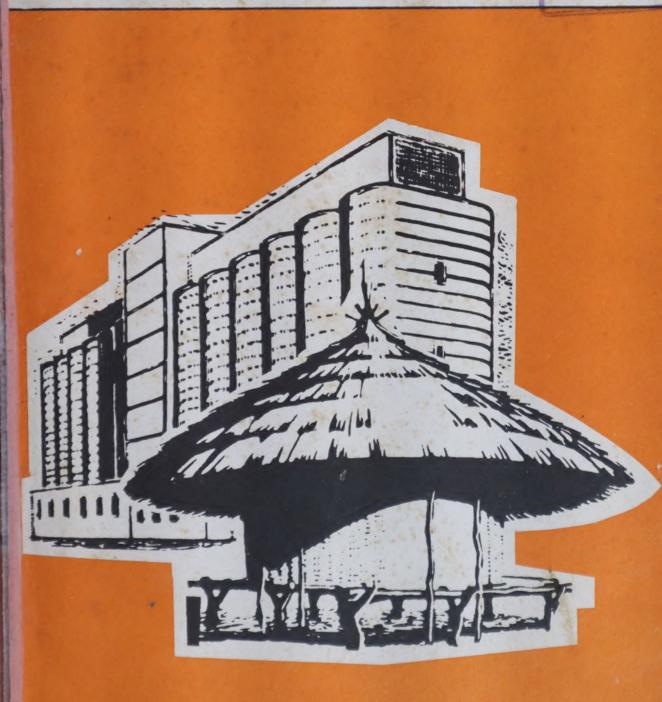
selection of recent abstracts relevant to the storage of durable agricultural produce in the tropics.

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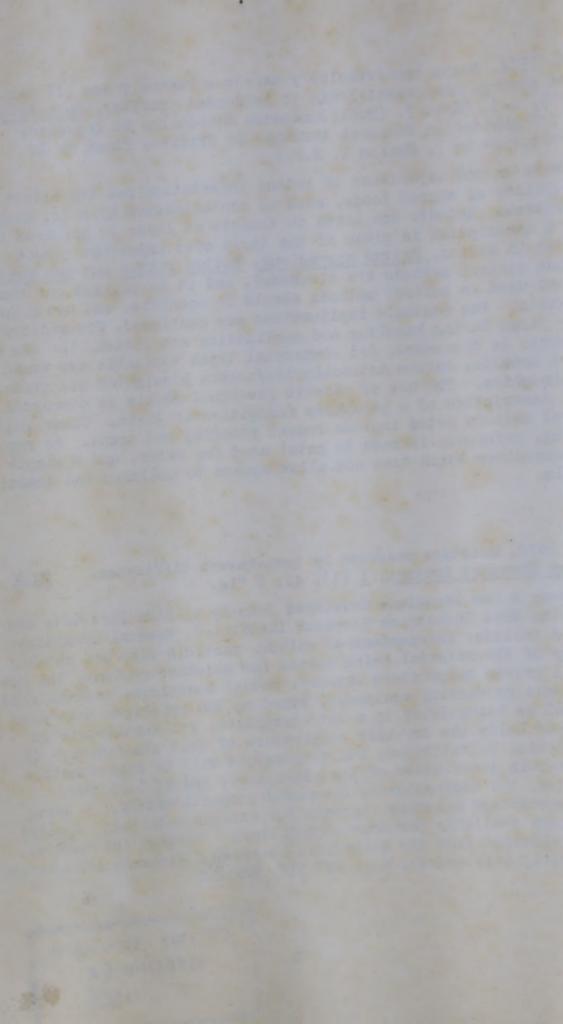
ANON. 1974. Buena conservacion y manejo = buenos pesos (II parte), (Good storage management leads to increased profits). Boln ANDSA, 4 (43), 4-5. (Span.). (Publ: Almacenes Nacionales de Deposito, S.A., Organizacion Nacional Auxiliar de Credito, Plaza de la Constitution No 7, Mexico 1, D.F.).

Comments on the importance of rodent infestation and its effect on the quality of stored foods, such as contamination by hair, urine and excreta. Rodents are known to transit at least 10 diseases of man. A description is given of the three most important rodent species in Mexico, Rattus norvegicus, Rattus rattus and Mus musculus Various control methods are discussed, and it is pointed out that poisons used in control methods should be specific, and not affect the grain. The economic implications are mentioned. Precautions to be taken during handling and application are listed. The use of fumigants is discussed, and commercial types available are named methyl bromide, carbon tetrachloride/carbon bisulphide 4:1 mixture and phosphine. The use of plastic gas-proof sheets is discussed and a description of a phosphine fumigation is given. Other rodent control methods noted include rodent proofing and traps. As regards baiting, reference is made to rats' need for water, and a simple bait container which does not allow access to children and domestic animals.

ANON. 1974. Moisture measured by temperature difference. Bulk Storage Movement Control, 1 (1), 41, 1 fig.

Discusses a new technique developed jointly by SIRA Institute and WIRA (The Wood Industries Research Institute). Several advantages claimed include: independence of colour, particle size and packing density of the material being tested for moisture content; the use of well proven temperature sensors; robust mountings; established electronic processing equipment. Based on the principle that when material is being dried in a hot atmosphere, its temperature is depressed below the dry-bulb temperature of that atmosphere. If the material is saturated, its temperature will be approximately the wet-bulb temperature of the atmosphere, and if less than saturated, the depression is decreased proportionately. A curve gives percentage moisture contents for various materials. Special probes are available for some commodities. Further information can be obtained from The Scientific Instrument Research Association, South Hill, Chislehurst, Kent BR7 5HE, England.



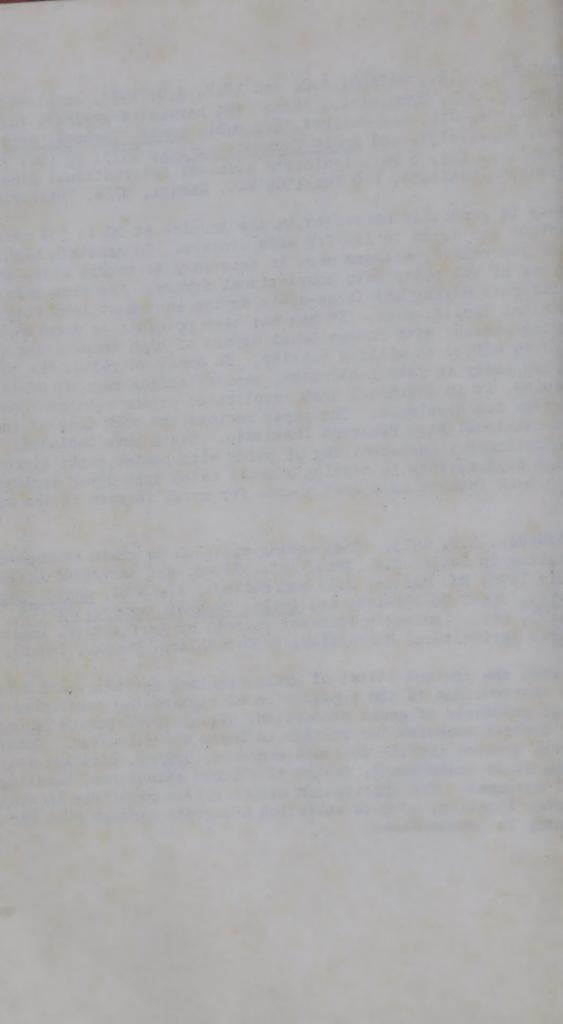


ARBOLEDA, J.R., MANALO, A.S. and KHAN, A.U. 1973. Accelerated drying of paddy. C.R. Symp. int., "Pres. wet harvested grains". Paris 1973. Ed. Multon, J.L. and Guilbot, A., publ. Annls. Technol. agric. Spec. No, 117-133, and Annls Technol. agric., 1973, 22 (3), 257-274, 5 tabl, 11 fig. 5 ref. (Author's address: International Rice Research Institute, P O Box 1300 MCC, Makati, D708, Philippines).

Paddy is generally harvested in the tropics at 20 to 30% moisture content and dried to 14% for safe storage. To maintain high head rice recoveries, extreme care is necessary to ensure slow, uniform drying of wet paddy with conventional dryers. The slow rate require multi-pass drying and large-scale drying equipment involving substantial capital cost. It has not been possible to accelerate the drying process with conventional dryers of high temperature without adverse effect on milling quality. In order to reduce the cost of drying paddy in labour-abundant, capital scarce regions of the tropics, it is essential that accelerated drying equipment and systems are developed. The paper reviews the work done at the International Rice Research Institute. Tests have included: conduction-drying-parboiling of paddy with heated sand; direct flame drying; work to develop a small batch type dryer employing a rice husk furnace as a heat source for rural farmers in the tropics.

BHATNAGAR, A.P. 1973. Engineering approach to grain storage and handling in India. C.R. Symp. int., "Pres. wet harvested grains", Paris 1973, Ed. Multon, J.L. and Guilbot, A., publ. Annls. Technol. agric., Spec. No, 151-164, and Annls. Technol. agric., 22 (3), 291-309 tabl, refs. (Author's address: College of Agricultural Engineering Punjab Agricultural University, 8/30 Ludhiana, Punjab, India).

Reviews the present status of grain handling in India, and examines the shortcomings in the application of engineering principles to these processes of grain production. Recent developments in engineering control measures for storage in India are discussed. Other topics covered include moisture contents, drying, airtight storage, temperature measurement, design of storage structures, handling, rail movement. The application of the system principle in grain storage location, process selection and grain storage plan for a country is demonstrated.



CARMI, Y. 1974. The toxicity of pirimiphos-methyl to Ephestia cautella (Wlk.). Prog. Rep. Israel Minist. Agric., Inst. Technol. Storage agric. Prod., Div. stored Prod. for yr 1973/74, 77-80 in Hebrew, Eng. summ. X, No 10. (Author's address: Ministry of Agriculture, Agricultural Research Organization, Institute for Technology and Storage and Agricultural Products, Division of Stored Products, Yafo, Israel).

The toxicity of pirimiphos-methyl to E. cautella was compared with that of three common insecticides, malathion, lindane and baythion Each insecticide was mixed with wheat grain at dosages of 2, 4 and 8 ppm. Two sizes of larvae were used; small, up to 3 mm long; larg over 5 mm. The insects were exposed to grain for 24 hr, after whice mortality counts were taken. Toxicity indicated was: baythion, pirimiphos-methyl, malathion, lindane in decreasing order. The toxicity of pirimiphos-methyl was almost equal to that of baythion at the 8 ppm level, but less at the lower levels. Differences were found in the susceptibility of the two sizes of larvae. With pirimiphos-methyl and baythion, the small larvae were the more susceptible; with lindane and malathion the small larvae were the more resistant at 4 and 8 ppm, but more susceptible at 2 ppm. A special note is made that lindane was slightly less toxic than malathion, which is known to be inefficient for moth control.

CHANET, M. 1974. Le sechage des semences de tournesol. Texte presente au cours de la 6eme Conference sur le Tournesol les 22, 23 et 24 Juillet, 1974, a Bucarest (Roumanie). (The drying of sunflower seed. Paper presented at the 6th International Conference on Sunflowers, Bucharest, Roumania, 22-24 July 1974). Inf. tech. CETIOM, 1974 (41), 13-20, 3 tabl, 2 graph. (Author's address: Engineer, Technologie Section, C.E.T.I.O.M., 174 Avenue Victor Hug. 75116, Paris, France.

Notes that sunflower seeds grown in France often fail to germinate and reseeding is necessary. The seed drying process was thought to be a factor, and tests are described to determine the effect of drying-air temperature, the depth of the grain layer during drying and the duration of the drying period. Tests included oven-drying, thin-layer (2 cm) drying, and thick layer (20 cm) drying, with varying temperatures and rates of airflow. Results indicate that the main factor is temperature. There is a significant reduction in germinative power at a temperature exceeding 65°C. The rate of airflow seems to have little effect. The higher the moisture content of the grain at harvest, the more necessary it is to lower the drying temperature. It is concluded that the current practice in France of drying sunflower with air heated to 45°C and moving a 3,000 m²/h/m², then cooling with natural air at the same airflow is not responsible for germination failure in the field.



CHANET, M. and BAUDET, J-J. 1974. La reglementation sur les humidimetres. (Regulations concerning moisture meters). <u>Bull. CETIOM</u>, 1974, (56), 12-16, 1 tabl, 1 fig. (Fr.). (Authors' address: Section de Technologie, C.E.T.I.O.M., 174 avenue Victor-Hugo, 75116, Paris France).

Gives a brief account of a decree, published in May 1974, for the control of commercially produced, rapid acting moisture meters. Th legislation is divided into four main parts. The first defines the moisture content of cereals and the moisture content and volatiles content of oilseeds, as being the loss in weight on a wet basis following treatment of a sample by a prescribed method - the exampl given is the drying of oilseeds at 102°C to a constant weight, The proportions of impurities and of broken grains in the sample must be within given limits. In the second part, constructional requirements are given, and these include a visible indicator, a printed record, and built-in systems to ensure the apparatus is operating correctly. The third part lays down limits of accuracy and requires certification of each instrument by S.I.M. (Service des Instruments de Mesure). Finally, the legislation lays down conditions for the use of the instruments. Examples are given of response limits for grains and oilseeds.

COYNE, P. 1974. The turn of the screw. Mech. Handling int., 61 (9) 33-36, illus.

Simplicity, reliability and dust free operation make screw conveyor a popular choice for handling powdered and granular materials. Versatility is also a key factor, and mixing, elevating and hopper discharge are all functions capable of being handled by screws. Details are given of the anatomy of a screw conveyor, and various modifications are described. Capacity charts as a function of screw diameter and rate of rotation are given for three load cross sections, and a list gives a comparison between power requirements capacities and other characteristics of belt conveyors, trough screws and tubular screws.

DHALTWAL, G.S., BHATNAGAR, A.P. and KAU, B. 1974. Infestation of stored paddy by Psocids. <u>Entomol. Newsl. 4</u> (8). (Author's address: Division of Entomology, Indian Agricultural Research Institute, New Delhi 110012, India).

Notes that a heavy infestation of stored paddy by Psocids,
Liposcellis sp., was recorded at Ludhiana in May 1974. The paddy
was stored in non-airtight metal bins for a period of about 4 mont.
There was no infestation in paddy stored in airtight metal bins and
in gunny bags. The paddy stored in gunny bags was of much lower



moisture content - 9.3%, than that in the airtight and non-airtight metal bins (14.6% and 14.4% respectively). Whilst the economic importance of the insect was not estimated, its presence in large numbers in the paddy is clearly undesirable and the likelihood of it becoming established as a pest is considered.

DOBIE, P. 1974, The laboratory assessment of the inherent susceptibility of maize varieties to post-harvest infestation by <u>Sitophilus</u> zeamais Motsch. (Coleoptera, Curculionidae). <u>J. stored Prod. Res.</u>, 10 (3/4), 183-197, 7 tabl, 3 fig, ref. (Author's address: Tropical Stored Products Centre, Tropical Products Institute, London Road, Slough SL3 7HL, Berks. England).

A biological technique for assessing the susceptibility of varieties of maize to post-harvest infestation by Sitophilus zeamais Motsch, has been developed. The effects of the age and population density of the parent insects upon the results obtained were invest: gated, and the possible effects of insect selection due to breeding upon particular maize varieties were looked at. Twenty-five Malawi. two Colombian and three Indonesian maize varieties were tested for susceptibility, and the results obtained were summarized using an 'Index of Susceptibility' which took into account both the F, progency developing during the tests and a measure of the average development period of these progeny. The effects of the proportion of floury endosperm in the maize kernels, the mean kernel weight, the 70% r.h. equilibrium moisture contents of the varieties, and the amylose contents of the varieties upon susceptibility were investigated using regression techniques. It was concluded that the hardness of the kernels, as estimated by the proportion of floury endosperm was related to susceptibility, and that the hardness was closely correlated with amylose content. However amylose may have a small effect upon susceptibility in addition to that associated with hardness. Egg plugs placed in the kernels of different varieties during standard susceptibility tests were counted, and no evidence was found that there was any relationship between the numbers of eggs laid and susceptibility. Therefore it was concluded that susceptibility was determinated in these varieties by factors operating after oviposition.



FOSTER, G.H. 1973. Dryeration: heated air drying and corn quality. C.R. Symp. int. "Pres. wet harvested grains" Paris 1973, Ed. Multon J.-L. and Guilbot, A., publ. Annls. Technol. agric., Spec. No,93-104 and Annls. Technol. agric., 1973, 22 (3), 233-244, 3 tabl, 2 fig, re (Author's address: Agric. Res. Serv., USDA, Grain Marketing Research Centre, Manhattan, Kansas 66502, USA).

This paper reports on research to develop methods of heated air drying that will cause less brittleness in dried maize. Dryeration was the first modification of high temperature, high speed drying, and is a combination of heated air drying and aeration cooling. Heated air drying is stopped when the grain moisture is about two percentage points higher than the desired final moisture content. Hot maize is moved from the dryer into a storage bin where it tempers from 4 to 8 hours before it is cooled slowly by ventilation with natural air. The moisture content is lowered to the final level during aeration cooling. Two-stage heated drying procedures were tested in an effort to reduce further the brittleness of the dried maize, but the reduction was not substantially greater than with dryeration. A system of partial heat drying using dryeration but removing hot maize from the dryer at 20% m.c. produced grain that approached the quality of that dried without heat. In partial heat drying, the final 4-5% of moisture content could be removed by aeration over a period of several months whilst the grain was in storage.

JILANI, G. and MALIK, M.M. 1973. Studies on neem plant as repellent against stored grain insects. Pak, J. sci. ind. Res., 16 (6), 251-254, 4 tabl, 2 fig, 18 ref. (Authors' address: Nuclear Institute of Agriculture and Biology, P O Box 128, Lyallpur, Pakistan).

Tests were carried out using estracts of three plants, 'neem', Melia Azadirachta L, 'ak' Calotropis procera Aid. and gardenia, Gardinia jasminoides Ellis against adults of Tribolium castaneum. The neem plant exhibited maximum repellency. Extracts from various parts of the neem plant, i.e. leaves, flowers, fruit exocarp and endocarp and seeds were tested against T, castaneum adults. Whilst all parts exhibited repellency, maximum effect was produced by seeds and endocarp. The extract of seeds was tested against larvae of T, castaneum and T, granarium, and against adults of Rhizopertha dominica. Least repellency was exhibited against adults of R, dominica. In flour treated with seed extract reproduction of T, castaneum was reduced, and totally inhibited at higher levels.



JONES, C.R. 1974. Better maize handling in Southern Nigeria.

<u>Appropriate Technol.</u>, <u>1</u> (2), 14-15, 3 fig. (Author's address: Technical Coordinator, Committee for Agricultural and Rural Development, Enugu, Nigeria).

Describes the conditions in which maize is harvested and stored, and comments that these encourage attack by pests. An account is given of a simple dryer normally wood fired but adaptable for use with a diesel driven fan and heater. Directions for operating the dryer include method of arranging the dehusked maize cobs, control of fire drying period, and suggested use of a simple moisture meter. Cement block stores, with netted ventilators instead of windows, asbestos roofing, and rodent proofing are recommended, and there are notes on phosphine fumigation. The dryer is stated to be capable of drying up to 12 tons of maize per month.

KADOUM, A.M. and LA HUE, D.W. 1974. Penetration of malathion in stored corn, wheat and sorghum grain. J. econ. Ent., 67 (4), 477-478 1 tabl, refs. (Authors' address: A M Kadoum, Assistant Entomologist, Dept. of Entomology, Kansas State University, Manhattan 66506, USA).

The rate at which malathion penetrated and degraded on wheat, maize and sorghum was determined during a 6-month storage period. Analyses made 24 h after treatment to determine initial residue deposit showed that 85% or more of the total residue remained on the exterior of the kernels of all 3 grains. During the first month of storage, residues increased internally but decreased pronouncedly on kernel exteriors. During the remainder of the storage period, malathion residue disappeared from the exterior of the kernels more rapidly than from the interior.

LECATO, G.L. 1974. Population growth and body weight of merchant grain beetles reared on cereals or peanuts supplemented with eggs or adults of the Indian meal moth. J. Georgia ent. Soc., 9 (3), 198-203 2 tabl, 10 ref. (Author's address: Stored Products Research and Development Laboratory, Agric. Res. Serv., USDA, Savannah, Georgia 31403. USA).

Population growth (increase in numbers of larvae, pupae and adults) and differences in adult body weight of Oryzaephilus mercator, reared on rice, wheat, maize and groundnuts supplemented with either dead adults or dead eggs of Plodia interpunctella were studied in the laboratory. Both population growth and weight increased significantly on supplemented diets. Generally, more and heavier progeny were produced when the diet was supplemented with dead adult moths than when eggs were used. Groundnuts formed the most favourable diets for beetles; rice was least favourable; supplemented cereals and groundnuts provided the most balanced diet.



LEESCH, J.G., GILLENWATER, H.B. and WOODWARD, J.O. 1974. Methyl bromide fumigation of shelled peanuts in bulk containers. J. econ. Ent., 67 (6), 769-771, 1 tabl, refs. (Author's address: Stored Products Insects Research and Development Laboratory, USDA, Agric. Res. Serv., Savannah, GA 31403, USA).

Tests were undertaken as part of the programme of the Bulk Handling Committee of the National Peanut Council to determine whether bulktype containers as an alternative to burlap bags, provide an accepta method of handling groundnuts. A frequent requirement is that the groundnuts be fumigated during transit or storage. Methyl bromide fumigations of 1-ton units of shelled groundnuts in bulk containers made of corrugated paper and of a 1-ton stack bagged nuts were compa: at a dosage of 32 mg/l (2 lb/1000 ft³). Penetration of the gas into containers was slower than into the bags, but concentrations of gas obtained were enough to kill larvae of Ephestia cautella, Plodia interpunctella, adults of Tribolium castaneum and Oryzaephilus mercator, and 0-3 day old eggs of T. castaneum exposed near the centre of each container and of the stack. Samples of nuts from the containers after fumigation had lower total bromide residues and higher percentage germination than samples from the bags. Such residues and reduction in germination were directly related to the concentration of fumigant achieved.

LUND, M. 1974. Calciferol as a rodenticide. <u>Int. Pest Control</u>, <u>16</u> (6), 10-11, 3 tabl. (Author's address: Danish Pest Infestation Laboratory, Skovbrynet 14, 2800, Lyngby, Denmark).

The author gives the results of tests carried out in Denmark which indicated that Calciferol (Vitamin D2) was equally successful whether used alone or in combination with warfarin against anticoagulant resistant rodents.

McKENZIE, B.A. 1974. You can save fuel in crop drying. <u>Wld Fmg</u>, <u>16</u> (9), 6-8, 24, 25; illus, 4 fig. (Author's address: Professor of Agricultural Engineering, Purdue University, Lafayette, Indiana, USA

Discusses the basic principles of grain drying by convection heat transfer. Points out that most of the moisture is usually removed in the first half of the drying period, and that economies can be effected by reducing or eliminating the second half. Quotes the use of an efficient moisture meter to avoid over-drying. Increased drying temperatures result, within limits, in increased mould active Suggested procedures for reducing fuel costs comprise: 1. use the dryeration process; 2. use a combination of fast and slow drying; 3. use a combination of both 1 and 2; 4. try to increase field drying combined with slow drying in deep layers; 5. add a stirring or



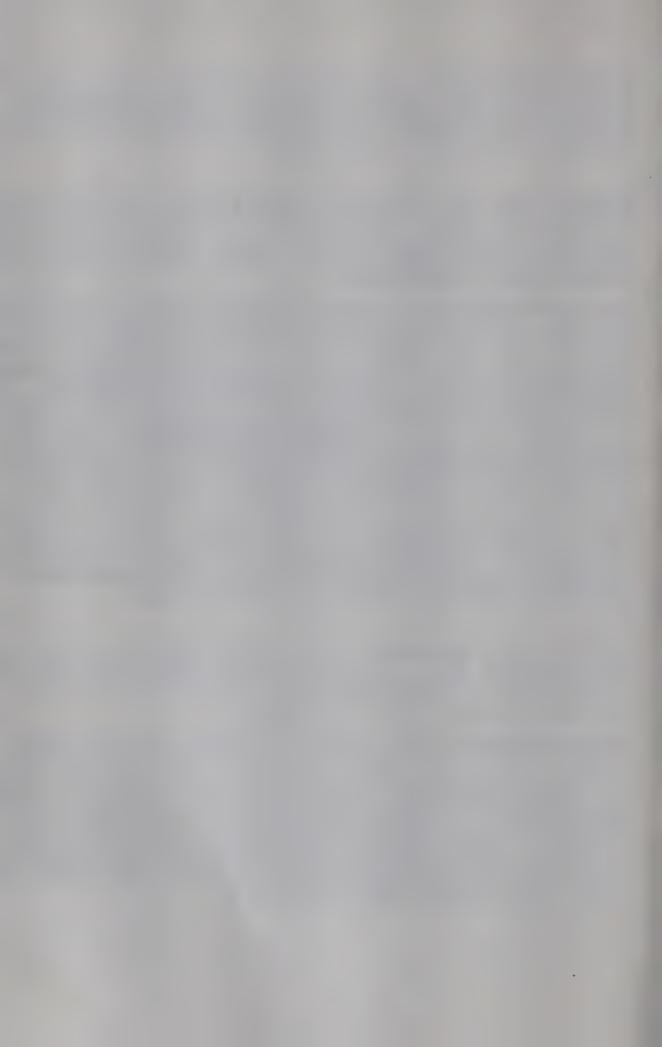
recirculating device to deep bed dryers. Finally, emphasis is place on the fact that the aim is an integrated system of harvesting, drying and storing grain, one that is profitable but sufficiently flexible to meet possible developments.

MONTE, G. Dal. 1974. Nuove prove sulla resistenza di alcuni materia da imballo all'attaco di insetti granivori. (New tests on the resis tance of some packaging materials to attack by granivorous insects) Rome: Minist. Agric. For., Div. Gen. Aliment., 48 pp, 3 tabl, 6 pl, 29 refs. (Ital. w. Engl. summ).

Tests were carried out to compare films with an isotactic polypropy lene base, and with a polyethylene lightboard and paper base. All materials tested are commonly used in Italy for packaging of foods such as pasta, flour and rice. Test species were Rhizopertha domini Sitophilus granarius, S. oryzae, and Tenebroides mauritanicus. In field studies, tests were carried out in a warehouse which already carried an infestation of Oryzaephilus surinamensis, R. dominica, S. granarius, S. oryzae, S. zeamais and Tribolium spp. None of the packing materials was completely resistant to insect penetration, but some were more vulnerable than others. The most susceptible were those with a natural organic base such as cellulose, paper, etc. and the most resistant were films based on synthetic preparation such as isotactic polypropylene. It is suggested that resistance is unlikely to be improved by increasing the thickness of the material but is more likely to be affected by factors such as smoothness, hardness, orientation and stretching of the material.

PUZZI, D. 1973. Conservação dos graos armazenados (Conservation of stored grains). 217 pp, tabl, 46 fig, refs. Publ. Editora Agronomica 'Ceres' Ltda, Rua Roberto Simonsen, 62-5°-Conj. 52, Caixa Postal 392 São Paulo, Brasil. (Port.) (Price unknown).

General handbook on grain storage in Brazilian conditions. Main chapters comprise: 1. organisation of grain in store; 2. chacteristics of stored grain; 3. determination of grain moisture content; 4. factors affecting the conservation of grain in store; 5. microfle of stored grain; 6. insects which attack grain in store; 7. control of pests; 8. grain drying; 9. storage methods; 10. handling and storage of grain in bulk; 11. farm storage; 12. quality standards of cereal and leguminous grains in store. Principal crops covered inclusive, beans, sorghum, soya beans and wheat.



ROGERS, R.R. and MILLS, R.B. 1974. Reactions of sorghum varieties to maize weevil infestation under three relative humidities. J. econ. Ent., 67 (5), 692, 3 refs. (Authors' address: Kansas Agricultural Experiment Station, Kansas State University, Manhattan 66506, USA).

Three varieties of sorghum, one resistant, one intermediate and one susceptible, were tested against Sitophilus zeamais in relative humidities of c.71, 58 and 43%. Six female and 3 male eleven day old adults were placed in each test chamber and left for 5 days oviposisthen removed. Total numbers of progeny after 52 days were recorded. Significant effects of varieties, effects of relative humidity, and variety/relative humidity reactions were obtained. The resistant variety exhibited an antibiotic effect at 43% RH, 84% of parent weevils being dead after 5 days oviposition. Parent weevils did not die in any other combination of variety and RH. It is deduced that resistance testing should be conducted over a range of humidities. Resistance was not associated with the ability of a variety to equilibrate at a lower moisture content for a given RH.

ROTH, H. and RICHARDSON, H.H. 1974. Broad bean weevil: methyl bromid fumigation of infested Faba beans. J. econ. Ent., 67 (6), 799, 4 ref (Author's address: Plant Protection and Quarantine Programs, Animal and Plant Health Inspection Service, Hoboken, NJ07030, USA).

Describes laboratory trials to determine the optimum dosage of methyl bromide for the complete kill of Bruchus rufimanus infesting broad beans (Vicia faba). Tests were carried out from 1959-1972, comprising 230 fumigations of some 125,000 beans with 1-10% infestation Individual samples were from 1-2 kg. It was noted that the efficient of the fumigation increased with temperature. Survival of one or more adults occurred with a dosage of 40 mg/l for 2½ hr at 32.8°C. Complete kill was obtained with 48 mg/l for 2 hr at 22.2°C. The results are not analysed statistically, for various reasons. Recommendations made in the United Arab Republic are quoted, and comprise 20-24 mg/l for 24 hr.

SCHALK, J.M., EVANS, K.H., and KAISER, W.J. 1973. Resistance in line of chick pea to attack by <u>Callosobruchus maculatus</u> in Iran. <u>FAO Pl. Prot. Bull.</u>, <u>21</u> (6), 126-131, 2 tabl, 14 fig, 4 ref. (Author's addre Vegetable Laboratory, Agricultural Research Service, Beltsville, Marland 20705, USA).

Forty-nine lines of chick pea (Cicer arietinum) were screened for free-choice oviposition preference by Callosobruchus maculatus.
Following the free-choice test, lines that were least preferred for oviposition were subjected to no-choice testing. The total number of eggs deposited per seed, total first generation emergence holes, number of damaged and undamaged seeds were recorded. Resistance is apparently related to the roughness of the seed coat.



SHEJBAL, J., TONOLO, A. and CARERI, G. 1973. Conservation of wheat in silos under nitrogen. C.R. Symp. int. "Pres. wet harvested grains" Paris 1973, Ed. Multon, J.-L. and Guilbot, A. Publ. Annls. Technol. agric., Spec. No., 631-643 and Annls. Technol. agric., 22 (4), 773-78 2 tabl, 5 fig, ref. (Author's address: Snam Progetti s.p.A., Laboratori Studi & Richerche di Base, Monterotondo, Roma, Italy).

Laboratory and semi-industrial experiments were carried out on the conservation of wheat at different moisture contents in silos in anaerobic conditions of a slow nitrogen flow (O2 content less than 0.5%). Although the controls were maintained in hermetically closed silos purged with pure air, insects developed and completely infested the grain. By a successive 10 days purge of infested silos with nitrogen, all insects (Sitophilus granarius, Tribolium confusum and T. castaneum) could be eliminated. No insect infestation developed in silos initially purged with nitrogen. No damage was caused by the anaerobic conditions, and mould counts were lower, even in high moisture grain, in nitrogen as compared with storage in air.

SPITLER, G.H., CLARK, J.D., COFFELT, J.A. and HARTSELL, P.L. 1974. Malathion as a protectant for in-shell almonds during storage. J. econ. Ent., 67 (4), 535-536, 1 tabl, refs. (Authors' address: Stored Products Insects Research Laboratory, Agric. Res. Serv., USDA, Fresno, CA93727, USA).

Malathion applied to in-shell almonds as a dust or spray protected them in store for one year from Indian meal moth, Plodia interpunctella (Hubner), saw-toothed grain beetle Oryzaephilus surinamensis L., and merchant grain beetle O. mercator. Initial residues of malathion were found to be 3.1, 7.4 and 16.1 ppm using a 5% dust and 3.03, 12.9 and 15.2 ppm for sprays. These malathion residues were distributed in a ratio of 96.5% on the shells and 3.5% on the nutmeat, on average. Damage as measured by percentage of nuts showing insect feeding in the four treatments was 70% less on treated than on untreated nuts. A taste panel found no detectable difference in odour or flavour between treated and untreated almonds.

STIRLING, H.G. 1974. Storage research: recent developments. The autocool silo. Kenya Coff., 34 (462), 253-256, 2 fig. (Author's address: Coffee Board of Kenya, P O Box 30566, Nairobi, Kenya).

The author defines some of the principles in the preservation of coffee quality during storage. On relating these to the climatic conditions in Kenya he explains why the indiscriminate use of natural air for ventilating coffee is undesirable. A system is described for selecting only suitable natural air, which uses a differential thermostat to control a ventilation fan. This will maintain coffee



in a silo at as cool a temperature as possible for any given climatic region. It is hoped that this will preserve the initial quality of the coffee over extended periods of time.

TAYLOR, W.E. and VICKERY, B. 1974. Insecticidal properties of limonene, a constituent of citrus oil. <u>Chana J. agric. Soc.</u>, 7 61-62 (Author's address: W.E. Taylor, Njala University College, Private Mail Bag, Freetown, Sierra Leone).

Citrus oil containing 98% limonene was obtained by steam distillation from the minced rind of the sour orange, Citrus aurantium. Tests were carried out under laboratory conditions using Callosobruchus phaseoli as test insect in airtight plastic and metal containers. Comparisons were made between limonene, ethylene dibromide and control. 100% mortality occurred within 24 hr with both compounds. Limonene was also tested against some commercial terpenes and other compounds including Dieldrex, with satisfactory results. Other terpenes like pinene, cincole, carvone, phellandrene and Terpincol also had insecticidal properties.

WILLIAMS, P. 1973. Grain insect control by aeration of farm silos in Australia. C.R. Symp. int., "Pres. wet harvested grains", Paris 1973, Ed. Multon, J.-L. and Guilbot, A., publ. Annls Technol. agric. Spec. No., 417-421, and Annls Technol. agric., 22 (3), 557-577, 4 refs. (Author's address: Victoria Plant Research Institute, Burnley, Victoria 3121, Australia).

Farm silo experiments in Victoria indicated that insect development can be controlled provided that grain is adequately cooled near the north west wall, the region subject to maximum solar heating in the southern hemisphere. Two silos each filled with 44 tonnes of wheat at 27°C and 11.5% m.c. were aerated with a unit operated by a prototype controllers, which selected the coolest periods each week for aeration. After 18 months storage, wheat was sampled during outloading of the silos and 13 insect spp. were found in each silo. One aerated silo was unshaded to the north west, with aeration ducting remote fro that region. Here a Rhyzopertha dominica infestation developed, producing heat and dust which retarded cooling. In the other silo, which was partially shaded, the ducting was closer to the north west wall and there was no localised infestation of R. dominica. Cooling the region most affected by solar heating can be improved by positioning of ducts to give air flow bias to the region, by shading, and by coating with reflective paint or insulating. Increasing the airflow must be limited to avoid undesirable increase in moisture content. The experiment was repeated using a commercial aeration controller, with ducting biased to the north west in the unshaded silo. After 18 months storage, infestation of R. dominica failed to develop.



YADAV, T.D. and KHANNA, S.C. 1974. Pusa Kothar - an improved grain storage structure. Ent. Newsl., 4 (6), 35-36, 1 fig. (Author's address: Division of Entomology, Indian Agricultural Research Institute, New Delhi 110012, India).

Describes how a room in a house was converted to a practically airtight and moisture proof store, by lining the walls and floor with polythene sheeting, then with bricks, to form a sandwich. A false roof was built of wooden poles and mud slabs, then covered with polythene, and finally with 5 cm thick mud plaster. After drying the structure was filled with wheat at 6.5% m.c., infested with Trogoderma granarium. After 6 months in store, the wheat was inspected for moisture content and germination, and both were found to be unchanged. Loss in weight was negligible, whilst wheat stored in an ordinary room or 'Kothar' as control, lost 7.86% in weight. An estimate of savings is given.

YADAV, T.D. and MOOKHERJEE, P.B.* 1974. Single, binary and tertiary mixtures of N₂, CO₂ and O₃ in seed storage. Ent. Newsl., 4 (9), 47-48. (Authors' address: Division of Entomology, Indian Agricultural Research Institute, New Delhi 110012, India). (* Deceased).

Brief report on laboratory trials on wheat at 10.5% m.c. stored in flasks, filled singly with CO₂, N₂, binary mixtures CO₂/N₂(50:50) or with low levels of O₂. A tertiary mixture CO₂/N₂/O₂ (46:46:8) was also used. Storage was at 27-1.5°C for six months, then gas contents were analysed and germination tested. Studies continued for two years during which slow diffusion of gases through rubber bungs and tubes was permitted and then for a further two years during which gas-tight glass fittings were used. There was negligible diffusion of gases, and germination remained at high level in all atmospheres for three years. Tests with CO₂, N₂ and their 50:50 mixture continued for the fourth year. Seed germination remained almost at the original level and was superior to openly stored controls. Concludes that airtight storage of seed in almost oxygen-free conditions is a promising and practical method.

YADAV, T.D. and MOOKHERJEE, P.B.* 1974. Tolerance of different hybrids and composites of maize seeds to fumigants. Seed Res., 2, 51-55, 1 tabl, 5 ref. (Authors' address: Division of Entomology, Indian Agr. Res. Inst., New Delhi 110012, India). (* Deceased).

Seeds of 16 hybrids and composites of maize were brought to a moisture content of c. 15% in laboratory conditions. They were then subjected to three fumigations, at intervals of three months. Fumigants used were ethylene dichloride/carbon tetrachloride (3:1



mixture), ethylene dibromide and phosphine (from Phostoxin). Dosages were 510 mg/l, 24 mg/l and 14 mg/l for periods of 24, 24 and 120 hours respectively. After each fumigation, samples were aerated for 2 weeks under room conditions, before germination tests were conducted. Storage was a 27-1.5°C and 50-70% RH. Varietal differences in the tolerance to fumigation were observed, and the third fumigation resulted in drastic decline in germination. The effect of phosphine fumigation was to reduce fungal growth and thus improve germination in some cases. A relation was noted between moisture content and effect of fumigation, and seeds with comparatively low (12-14%) m.c. were less affected. In the case of phosphine the effect of high moisture content was increased by the longer exposure period of 120 hours. The need for thorough aeration after fumigation is emphasised.

The editor regrets that he is unable to supply reprints or photocopies of items abstracted. For this reason the names and addresses of authors are given whenever possible, to enable readers requiring further information to apply direct.

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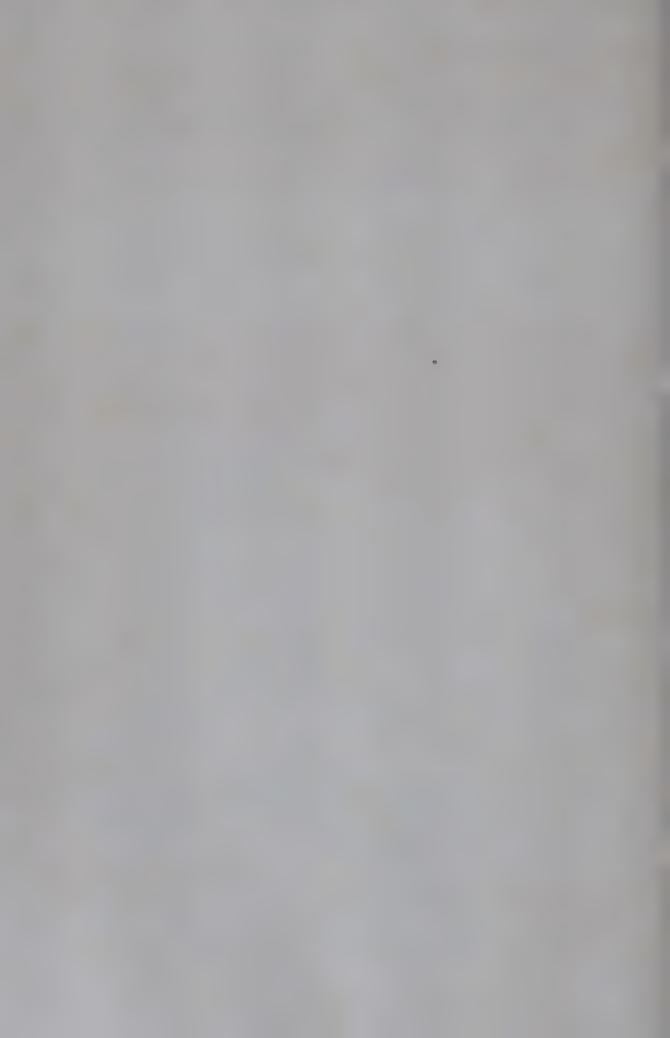
Tropical storage abstracts

A selection of recent abstracts relevant to the storage of durable agricultural produce in the tropics.

Issued by the Tropical Stored Products Centre (Tropical Products Institute), RILLIE London Road, Slough, SL3 7HL, Buckinghamshire, England. 1 AUL 19/5

Editor: J. R. O. Humphries, M.A.





MYSO

ASHMAN, F. 1975. Pest control and storage problems in feed commodities in tropical and subtropical countries. Proc. Conf. Anim. Feeds trop. subtrop. Origin, London 1-5 April 1975, 267-272, 4 tabl. ref. (Author's address: Tropical Products Institute, Tropical Stored Products Centre, London Road, Slough SL3 7HL, England).

Discusses the factors affecting quality of primary crops and other commodities in storage, in particular moisture content and temperature. Engineering aspects include design of storage structures and machinery to facilitate hygiene and segregation of stocks. disinfestation methods (e.g. insecticides persist longer on cool surfaces with low pH), provision of moisture barriers and heatreflecting surfaces. Bulk storage permits the use of the most efficient and economic pest control measures, and can be combined with low volume aeration for cooling, whilst hermetic storage of bulk material will give effective control. Plastic sheets provide barriers against reinfestation following fumigation but may give rise to condensation problems. Fumigation using methyl bromide and phosphine is discussed, and rates of dosage and some experimental results are given. Some details are given of the use of insecticides for surface sprays, for direct admixture with raw or partially processed materials and for space treatment, for instance dichlorvos against Ephestia cautella. Some effects of processing on insect pests, such as expeller extraction of oilseeds are noted, and finally the importance of packaging is emphasised.

ASHMAN, F., WEBLEY, D.J. and ACHILLIDES, N.Z. 1974. Space treatment of warehouses using dichlorvos (Paper presented at the EPPO Conference on storage pests and diseases, Paris, 11-14 June 1974).

EPPO Bull., 4 (4), 429-445, 13 tabl, 5 fig, 4 ref. (Authors' address: Tropical Stored Products Centre, Tropical Products Institute, London Road, Slough SL3 7HL, England).

Details are given of the performance of Vapona Pest Strips and of an automatic dichlorvos sprayer developed to prevent infestation of clean or fumigated stored commodities, for infestation control on stored carobs. Air concentrations after spraying a nominal dose of 10 $\mu g/l$ of total store space averaged approximately 1.0 $\mu g/l$ after 30 minutes and less than 0.3 $\mu g/l$ after 3 hours. Residues found on carobs after daily spraying of stores at 10 $\mu g/l$ for 96 days were in the range of 0.2 - 2.0 ppm. Ephestia cautella Walk. and Lasioderma serricorne (F.) become established in carobs after harvest and are the principle pests causing damage during storage. Effective control of E. cautella was obtained by using Shell Vapona Pest Strips at two strips/100m³ or by daily spraying of



dichlorvos at 10 g/1,000m³ (10µg/1). No effect was observed against migrating larvae of E. calidella (Guen.) or E. figulilella Greg. nor against Bracon hebetor Say, the hymenopterous parasite attacking all three Ephestia species. The automatic dichlorvos sprayer is equipped to apply a predetermined dose at time of peak flight activity, 18-20 hours each evening. On stored carobs, no spraying is needed after October because the commodity temperature falls below 20°C, too low for active development of the pest species. 23 automatic sprayers are now used in Cyprus to protect the whole carob crop from storage pests.

BANKS, H.J. and ANNIS, P.C. 1974. Storage in inert atmospheres - physical methods of control. Lethal exposure period to inert atmospheres. CSIRO Div. Ent. A. Rep. 1973-74, 31-32 (Abstract only). (Authors' address: Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, P O Box 1700, Canberra City, A.C.T. Australia 2601).

Earlier workers seem to have underestimated the time required to destroy pests by this method. For example, at least 7 weeks are necessary at low oxygen concentrations (1.3%) to destroy all Sitophilus granarius at 18°C and 60% CO₂ air mixture require over 2 weeks to effect control.

BANKS, H.J., BAILEY, S.W. and ANNIS, P.C. 1974. Storage in inert atmospheres - physical methods of control. Use of nitrogen. CSIRO Div. Ent. A. Rep. 1973-74, 31 (Atstract only). (Authors' address: Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, P O Box 1700, Canberra City, A.C.T. Australia 2601).

The feasibility of storing grain economically and effectively in low oxygen/high nitrogen atmospheres has been further examined. One trial was carried out in a 2,000 tonne vertical concrete bin. Tests of the bin following sealing gave a standing pressure of 1.4 mb at an input rate of 1 m³ air/min. Standing pressure was found to be proportional to the square of the input rate, as expected. Nitrogen gas was then introduced at the base of the bin at about 3 m3/min. Air was found to be directly displaced by the nitrogen front in the bulk of the grain and the oxygen tension diminished exponentially in the large head space. About 1.1 m³ nitrogen was used per tonne of grain, reducing the oxygen concentration to 1% or less at all points sampled. After the initial purging the nitrogen flow was maintained for 5 days at a rate of 0.6 m³/min. which kept oxygen concentrations below 2%. Further reduction of this rate of 0.2 m3/min. allowed too much air to enter the bin. It was clear that the maintenance of an adequately low oxygen tension would require unpractical quantities



of nitrogen unless further sealing of the bin, or even of the complete structure, improved the situation. Another trial was carried out in a squat, 2,000 tonne steel bin with a concrete floor. The seams of the bin were sealed and it was loaded with malting barley. Tests gave a standing pressure of c. 2.5mb at an input rate of 0.1 m³/min, showing a high degree of sealing had been achieved. Nitrogen, 1.6m³/tonne, was introduced through the aeration system, giving an atmosphere equal to or less than 1.3% oxygen at all but three sampling points. A flow of nitrogen was then maintained at a rate of 0.05 m³/min, which kept oxygen below 0.5% for 28 days. This trial demonstrated that it was feasible to use nitrogen as a lethal atmosphere for grain storage in suitable structures.

BISHOP, G.S. 1975. The calculated risk. Ceres, FAO, 8 (1), 28-30 2 photo. (Author is Chairman of Booker McConnel Limited).

Discusses the recommendation made at the World Food Conference, 1974, for the development of a long term plan for the coordination of national policies for the stockpiling of basic commodities. mainly grain, to eliminate fluctuations in world stocks and food shortages. The heavy costs involved in purchase, shipment, storage and pest control measures such as pesticides and regular turnover of stocks are considered. It is suggested that main stocks should be located near commercially established centres of production. with adequate storage and shipping facilities. The effects of large purchasing and stockholding organisations are noted, and the need for commercial expertise is emphasised. Theoretically, it is suggested that one grain reserve in North America, supported by EEC reserve stocks, together with reserves in Argentina and Australia would be the most economical arrangement. The need for studies on the most economical storage facilities for long term storage of, say, wheat in the tropics, with satisfactory methods of minimising losses due to insect damage and humidity is pointed out, as is the need for full and thorough logistic arrangements. Finally the author comments that the high capital costs and high interest rates, together with other ineritable losses, must be met, and the decision as to who is responsible must be made.

CASWELL, G.H. 1975. Grain storage problems in Nigeria. Samaru agric. Newsl., 17 (1), 2-3 (Author's address: Senior Entomologist, Institute for Agricultural Research, Ahmadu Bello University, P M B 1044, Zaria, Nigeria).

Points out the problems resulting from the significant increase in the urban population, which is no longer able to grow sufficient food to feed itself. Considers present farming and food storage



methods and puts forward the suggestion that whilst these should be retained (but improved) in rural areas, a new approach is required to the feeding of large urban areas. The author advocates large mechanised farms where results of research can be applied. In Nigeria, it is suggested that maize should be grown in the drier savannah areas, e.g. Samaru. Here the crop is harvested at 12% m.c. and frequently dries out in store to 10% m.c. This obviates the need for costly artificial drying. Points out that such dry conditions inhibit the multiplication of pests such as Sitophilus, and similar factors apply to sorghum and millet, so main storage centres should be in the same dry areas. The use of bag storage is advocated, and the author comments on the number of bulk storage silos throughout the country which are unused. An exception is made for cowpea, which is very susceptible to insect attack even in dry areas, and which might best be stored in silos. Finally, the need for improved communications to facilitate efficient marketing is emphasised.

CHAMP, B.R. 1974. Pesticide resistance patterns. CSIRO Div. Ent. A. Rep. 1973-74, 3. (Abstract only). (Author's address: Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, P O Box 1700, Canberra City, A.C.T. Australia 2601).

Knowledge of the patterns and levels of resistance developing in the field following use of particular insecticides is a pre-requisite to planning of control programmes and, supplemented with data from laboratory intensification of resistance, will assist selection of suitable alternative materials and help establish an insight into the mechanism of resistance and its mode of inheritance. Laboratory selected and field strains of Tribolium castaneum,

T. confusum, Sitophilus oryzae, S. granarius, Rhyzopertha dominica

Oryzaephilus surinamensis, resistant to malathion, have been tested with a range of insecticides, including 14 organophosphorus compounds, and synergists. Strains of all species have shown cross-resistance to a wide range of these compounds.

CHAMP, B.R. 1974. World survey of pesticide resistance. CSIRO Div. Ent. A. Rep. 1973-74, 36. (Abstract only). (Author's address: Commonwealth Scientific and Industrual Research Organisation, Division of Entomology, P O Box 1700, Canberra City, A.C.T. Australia 2601).

This survey sponsored by the Food and Agriculture Organization of the United Nations and conducted in conjunction with the Pest Infestation Control Laboratory of the United Kingdom continued during the year. Sixty-four countries were visited to collect strains of the major grain pests and seek information on their



local importance, and samples were obtained from a further 44 countries. Collection finished during August and examination of the resultant 1,400 strains for susceptibility to malathion. lindane, methyl bromide and phosphine is almost complete. There is widespread resistance to malathion in the Tribolium species (>90% of countries sampled) with Rhyzopertha dominica showing the next highest frequency (50%) followed by Sitophilus oryzae and S. granarius (both 23%), Oryzaephilus surinamensis (17%) and O. mercator (11%). Malathion resistance was not recorded from S. zeamais. Lindane resistance was present in all species and involved 104 of the 108 countries sampled. It was particularly prevalent in S. oryzae, S. zeamais, T. castaneum and O. surinamensis. The emergence of resistance to fumigants is of particular concern because the world has been dependent on fumigation both as a routine disinfestation treatment and as an alternative for combatting insecticide-resistant strains. Methyl bromide resistance was detected in 14 countries and phosphine resistance in 27 countries. Resistance levels were generally low and in most instances would not have resulted in breakdown of pest control. The species particularly involved were Rhyzopertha dominica and Tribolium confusum. Although fumigant resistance does not yet appear to be a practical problem, the widespread occurrence of strains surviving treatment with doses that would normally be expected to kill susceptible strains, and the ease with which the resistance of the strains can be increased by laboratory selection, probably indicate that a serious situation may develop.

CHATURVEDI, G.A.C. 1974. Damage by rats and their control. Pesticides, India, 8 (10), 33-42, 3 tabl, 31 ref. (Author's address: Rodent Control Project, CRS/USAID/Farmers Friends Association, Bindu Sarovar, Sidphur 384151, Gujarat, India).

Review article. The introduction gives a brief account of the history of rodents in India and their development in and threat to both rural and urban areas. The principal species involved are Rattus rattus, Rattus norvegicus, Mus musculus and Bandicota bengalensis. A general description is given of features which account for the success of domestic rodents, including high reproductive potential, good vision, omnivorous taste, agility, swimming ability, etc. Damage caused is discussed under three headings: food losses - direct and result of contamination; damage to structures, electric wiring, etc; public health hazards such as plague, leptospirosis and other diseases. Control measures discussed are: mechanical (hunting and trapping); chemical - acute poisons and anticoagulants, fumigants, chemosterilants and repellents; biological control by predators



and induced diseases; environmental control such as rat-proofing, garbage removal. Some details are given of the administration of barium carbonate, zinc phosphide, norbomide and anticoagulants. There are notes on precautions and antidotes. One table gives diagnostic characteristics of the four main species and another gives the economics of control operations in a selected village.

DARAMOLA, A.M., ADJIBOLA TAYLOR, T. 1975. Studies on the reinfestation of kola in store by kola weevils in Southern Nigeria. Short Commun. J. stored Prod. Res., 11 (1), 61-63, 1 tabl, 7 ref. (Authors' address: Department of Agricultural Biology, University of Ibadan, Nigeria).

The most important pests of kola nuts (Cola acuminata and C. nitida) in West Africa are the weevils Balanogastris kolae, Sophrorinus insperatus, S. duvenoyi, S. kolae, S. pujoli, S. quadricristatus and S. schedli. They first attack the nuts on the trees and are brought into store, but can also attack clean nuts in storage. Storage prior to sale may last for six weeks, and nuts which become heavily infested are hand picked and discarded. A trial is reported on the rate of spread of infestation from rejected nuts to clean nuts. A sample of 2000 nuts was drawn from a major kola sale depot near Ibadan, Nigeria, and was found to contain approximately 5.3% insect-damaged nuts. The sample was divided into two equal parts, each being packed in a basket lined with leaves in the usual manner, and one being kept in the depot with other nuts, the other being kept in the laboratory. Similar samples of rejected nuts were kept, one near the shed at the depot, one in a cage in the laboratory. Emergences of weevils from the latter were recorded daily. Results clearly indicate that cross infestation at the depot greatly increased the number of infested nuts in the saleable sample as compared with those kept in the laboratory. Recommendations are made for store hygiene and disposal of rejected nuts.

DESMARCHELIER, J.M. 1974. Toxicity of insecticides. CSIRO Div. Ent. A. Rep. 1973-74, 37 (Abstract only). (Author's address: Commonwealth Scientific and Industrial Research Organization, Division of Entomology, P O Box 1700, Canberra City, A.C.T. Australia 2601).

Laboratory and field studies have shown that none of the organo-phosphorus (OP) insecticides likely to be cleared for use in the next 2 to 3 years can control all strains of Rhyzopertha dominica. Toxicity of OP insecticices to Rhyzopertha is related both to concentration of insecticide and to the time that has elapsed since treatment. Thus, a concentration that may effectively disinfest grain of Rhyzopertha one day after treatment is ineffective if it is the result of a higher concentration applied one month earlier,



implying that some unknown change or factor is involved. Therefore, no OP insecticide tested in this laboratory can disinfest grain of this insect if post-harvest infestation occurs. Rhyzopertha dominica can be controlled by prethroids and by carbaryl, and natural pyrethrum and bioresmethrin are compatible with six OP insecticides tested. Combination enchances their toxicity and is required to overcome the most resistant strains.

DYTE, C.E. 1974. Problems arising from insecticide resistance in storage pests. (Paper presented at the EPPO Conference on storage pests and diseases, Paris, 11-14 June 1974). EPPO Bull., 4 (3), 275-89, 7 tabl, ref.(Author's address: Pest Infestation Control Laboratory, London Road, Slough SL3 7HL, England).

A survey of the occurrence of insecticide or fumigant resistant strains of stored-product insects is given. Studies on the geographic distribution of insecticide resistance show that in some cases resistance is localised, and in others it is almost universal. Tribolium castaneum is known to be resistant to lindane in 71 countries, and lindane-resistant strains of Oryzaephilus surinamensis, Rhyzopertha dominica, Sitophilus oryzae and Sitophilus zeamais occur in over 30 countries. Malathion-resistant T. castaneum strains are known from 70 countries, and T. confusum and R. dominica resistant to malathion are known from 25 countries. Resistance to fumigants appears to be uncommon but field strains resistant to methyl bromide, phosphine or ethylene dibromide have been reported. Cross-resistance has been studied in few strains, but malathion resistance may involve resistance to other organophosphorus compounds in at least 6 species. Although resistance to pyrethroids and juvenile hormone analogues is known, these compounds show promise for future use against storage pests.

FREEMAN, J.A. 1974. A review of changes in the pattern of infestation in international trade. (Paper presented at the EPPO Conference on storage pests and diseases, Paris, 11-14 June 1974). EPPO Bull., 4, (3), 251-275, 17 tabl, refs. (Author's address: Pest Infestation Control Laboratory, London Road, Slough SL3 7HL, England).

Changes in the degree and kind of infestation by storage insects and mites in imports into Great Britain since the EPPO Conference in Lisbon 1967, are reviewed. There has been an overall fall in the percentage of infested cargoes, from 33% in 1967 to 23% in 1973, and a corresponding fall in the incidence of occurrence of many species. The various changes in different classes of commodities, cereals, oilseeds, cocoa beans, etc.according to country of origin, are discussed in detail. The effects of containerisation and greater



use of road transport, the growing problem of insecticide resistance in storage insects and mites and the significance of infestation in imports are discussed in relation to future developments in international trade.

GHALY, T.F. 1973. Comparison of in-shell peanuts after controlled and naturally ventilated storage. Proc. 23rd a. Conf. Roy. Aust. chem. Inst., Cereal Chem. Div. Adelaide, 1973, 85-96, 4 tabl, 3 fig. 6 ref. (Author's address: Division of Mechanical Engineering, CSIRO, Highett, Victoria, Australia).

A comparison of three systems of aeration of bulk stored groundnuts showed the upward and downward flow forced aeration to be superior to natural ventilation (through fitted cages) in preserving seed quality and minimising insect infestation problems. However the downward-aeration system is not recommended because of the problems that were associated with it. The pick-up of moisture at the surface of the bulk combined with hot air conditions resulted in heavy infestation, mainly Tribolium castaneum at the surface. Bulk analyses showed the average infestation level of the unaerated bins to be about five times that of the aerated bins. Careful assessment of the weighted average moisture content of the aerated groundnuts showed a negligible loss (0.1%) after 10 months storage. Other quality aspects such as germination and free fatty acid content, did not reveal significant differences.

GOLOB, P., ASHMAN, F. and EVANS, N. 1975. The separation of live stored product insect larvae from flour or sievings using a modified Tullgren funnel. <u>J. stored Prod. Res.</u>, <u>11</u> (1), 17-23. (Author's address: Tropical Stored Products Centre (TPI), London Road. Slough. SL3 7HL, England).

A modified commercially available Tullgren funnel was used to separate live, early or late instar larvae from 200g (2.5 cm deep) and 400g (5.0 cm deep) samples of wheat flour or kibbled maize. Larvae were extracted more readily from the 200g samples even though temperatures were lower after 24 hr than in the larger samples. Only 26% of early instar larvae of Tribolium castaneum were recovered from the 400g samples of wheat flour in 24 hr, but all other trials with larvae of this insect yielded 85% recovery or higher. In the case of Lasioderma serricorne, Trogoderma granarium and Ephestia cautella, recoveries were highest for late instar larvae in 200g of kibbled maize and lowest from 400g of wheat flour. Oryzaephilus surinamensis larvae could not be adequately extracted from wheat flour alone, but when non-infested kibble maize was mixed with it, up to 58% recovery was obtained. It is concluded that the modified



Tullgren funnel would provide a useful method for extraction of live insect larvae from samples of finely divided food such as flours or meals.

KASHI, K.P. and BOND, E.J. 1975. The toxic action of phosphine: role of carbon dioxide on the toxicity of phosphine to <u>Sitophilus</u> granarius (L.) and <u>Tribolium confusum</u> Du Val. <u>J. stored Prod. Res.</u> 11 (1), 9-15, 5 tabl, 4 fig, refs. (Authors' address: Research Institute, Agriculture Canada, London, Ontario N6A 5B7, Canada).

Carbon dioxide was found to potentiate the action of phosphine against a normal strain of Tribolium confusum and normal and resistant strains of Sitophilus granarius so that the length of the exposure period could be reduced. Studies on respiration showed that there was a 20 per cent increase in oxygen consumption in the presence of 4% carbon dioxide but no further increase up to 64% carbon dioxide level. Phosphine uptake on the other hand increased steadily with increase in carbon dioxide level and there was a concurrent increase in toxicity up to three-fold. Carbon dioxide enhanced toxicity when applied simultaneously with phosphine but not when applied before or after phosphine treatment.

KHAN, A.U., AMILHUSSIN, A., ARBOLEDA, J.R., MANALO, A.S. and CHANCELLOR, W.J. 1974. Accelerated drying of rice using heat conduction media. <u>Trans. ASAE</u>, <u>17</u> (5), 949-955, 5 tabl, 13 fig, 7 ref. (Authors' address: A.U. Khan, J.R. Arboleda, A.S. Manalo; International Rice Research Institute, Los Banos, Laguna, Philippines).

In laboratory tests, sand drying was optimum with 204°C sand temperature and 15 sec exposure time, with a paddy/sand ratio of 1:20 and 30% initial grain moisture content (dry basis). The high temperature gelatinised starch granules, sealing cracks and fissures and minimizing grain breakage during milling. Using a continuous flow laboratory sand drier, paddy emerged with a dry basis moisture content approximately 65% of that with which it entered the drier. Sealing paddy in airtight containers immediately after the 15 sec exposure resulted in increased head yield compared with that of the unsealed control, for paddy with initial moisture Higher sand temperature was required to achieve content below 25%. similar results with paddy with a lower initial moisture content. Sand-treated, presoaked samples compared to control, required 3 to 6 times longer in the mill to remove the same amount of bran. A sand temperature of 150 to 180° resulted in the best appearance and translucency. Sand treated samples appeared more desirable than the commercially parboiled rice of Asian countries. Tests were also conducted with liquid petroleum gas in a laboratory scale



continuous flow direct flame drier. Gelatinisation of starch granules occurred in all test runs. Direct-flame followed by heated air drying gave 50% reduction in drying time. Direct-flame drying followed by shade drying gave high head rice yield. Sealing in airtight containers immediately after drying increased head rice yield. Little difference between sand drying, flame drying and control was noted by a taste panel.

LEN, S.C. and MOHAMED, Z.A. Bin Hj. 1974. Underwater storage of high moisture padi in sealed containers and its effect on quality. Malay agric. Res., 3, 145-151, 3 fig. (Author's address: Faculty of Agriculture, University of Malaya, Kuala Lumpur).

Trials involved rice padi at moisture contents of 13, 16, 19 and 22% stored in normal air and in a nitrogen atmosphere. The padi was sealed in polythene bags, and one set of samples was stored underwater, the other set being kept under an open shed. Sampling was carried out fortnightly for the first month and then at monthly intervals for three months, Moisture reduction taking place under the different storage conditions is discussed. There was little variation in total milling yield, except for padi stored at 22% which gave a lower value. Milling head yield was significantly affected, padi at 22% initial m.c. giving a sharp reduction in value, whilst underwater storage gave a slightly higher value. The taste value decreased with increased time of storage, and the odcur of the cooked rice increased.

LILLEHOJ, E.B., FENNELL, D.I. and HARA, S. 1975. Fungi and aflazin in a bin of stored white maize. <u>J. stored Prod. Res.</u>, <u>11</u>, (1), 47-51, 2 tabl, 1 fig, refs. (Authors' address: Northern Regional Research Laboratory, Agric. Res. Service, US Dept. of Agriculture, Peoria, Illinois 61604, USA).

Samples of maize from discoloured spots in the surface layer of stored grain in a southeast Missouri bin were examined for variation in microbial profile and for the presence of aflatoxin. Comparisons were made with samples of non-discoloured maize from the same bin. Deteriorated test kernels showed a high incidence of Penicillium, Absidia, Mucor, Rhizopus and Fusarium spp., as well as bacteria and yeasts. Aspergillus species were also Trequently observed; A. flavus was the most common species in this group. In one sample of discoloured maize 80 per cent of the kernels contained A. flavus and the sample had 0.40 ppm aflatoxin B₁. Other fractions exhibited extensive discoloration but no aflatoxin.



OSUJI, F.N.C. 1974. Beetle infestation in dried fish purchased from a Nigerian market, with special reference to <u>Dermestes maculatus</u> Degeer. <u>Nigerian J. Ent., 1</u> (1), 69-79, 2 tabl, 4 fig. refs. (Author's address: Department of Zoology, University of Ibadan, Ibadan, Nigeria).

A nineteen-month survey of infestation carried out in the Ibadan market, Nigeria, showed that a high proportion of the dried fish sold in the market harboured beetle infestation, mainly <u>Dermestes maculatus</u> Degeer and <u>Necrobia rufipes</u> Degeer. <u>D. maculatus</u> was the dominant pest, accounting for about 71.5% of the observed infestation, and <u>N. rufipes</u> was next in importance, accounting for 28.0%. The larvae of both beetles were the most numerous forms and were responsible for a large proportion of the damage inflicted on dried fish. The analysis of the monthly levels of infestation showed that both species were abundant all the year round. The peak levels of infestation were, however, generally recorded in the hot dry months of the year, while the lowest levels were observed in the rainy months. The survey established that with respect to dried fish, <u>N. rufipes</u> is probably more important in Nigeria than has so far been reported elsewhere.

OSUJI, F.N.C. 1975. Some aspects of the biology of <u>Dermestes</u>

<u>maculatus</u> <u>Degeer</u> (Coleoptera, Dermestidae) in dried fish.

<u>J. stored Prod. Res.</u>, <u>11</u> (1), 25-31, 1 tabl, 3 fig, refs.

(Author's address: Department of Zoology, University of Ibadan, Ibadan, Nigeria).

The development of <u>Dermestes maculatus</u> Deg. in dried fish has been studied under uncontrolled laboratory conditions. Females laid aggs within 12 hr of copulation and oviposition was improved by the presence of free water. Hatching occurred about 48 hr after oviposition. The characteristic appearance of the egg and the changes that occurred during incubation and hatching are described. Larval development was completed in 33.5 days during which seven moults occurred and a body length of 14 mm was attained. Larval life was prolonged by crowding. When intact pieces of fish were available, the last instar larva bored into one of them and pupated within the hardened larval skin, but when ground fish was provided, a quiescent prepupal stage was observed. The adult emerged about 11 days after the last instar larval stage, irrespective appet the mode of pupation.



PADUA, D.B. de 1974. Post-harvest protection and processing of rice. "Interaction of agriculture with food science", Proc. interdisciplinary Symp., Singapore, 22-24 February 1974, 111-120. (Author's address: Department of Agricultural Engineering, College of Agriculture, University of the Philippines at Los Banos College, Laguna, Philippines).

The methods of getting the harvest to the processing plant need to be changed, eliminating middlemen and speeding up delivery to keep pace with increased yields, the characteristics of new varieties and the wet-season harvest. Problems and strategies are reviewed covering production, drying, storage, milling and processing plant and management operations, based on observations made during visits to Malaysia, the Philippines, Thailand and Indonesia. An action plan is recommended, involving the following: engineering research, design and development to improve existing technologies; field testing for technological efficiency and redesign for manufacturing with existing country capabilities; operating research to assist planners and policy-makers and central management; and intensive training for managers, technicians and extension engineers.

PARISH, R.L. and SHELBY, K.R. 1974. Effect of seed cotton storage on seed and lint quality. <u>Trans. ASAE</u>, <u>17</u> (6), 1078-1079, 1084, 2 tabl, 12 ref. (Authors' address: Agricultural Engineering Department, University of Arkansas, Fayetteville, USA).

Tests were carried out on storage of seed cotton in free-standing stacks of modules or bales. They established that if seed cotton is stored at a proper moisture content, properly covered with a carpaulin, and placed on an elevated platform to avoid contact with the ground or standing water, storage does not cause loss of quality in either seed or lint. No limiting seed cotton moisture content was established, but in general germination was not affected by an initial moisture content of 15.3% or less. A slight decrease in lint quality occurred with increasing seed cotton moisture content, but no sharp drop occurred below 18%.

PIXTON, S.W. and WARBURTON, S. 1975. The moisture content-equilibrium relative humidity relationship of rice bran at different **emperatures. J. stored Prod. Res., 11 (1), 1-8, 2 tabl, 9 fig, refs. (Authors' address: Ministry of Agriculture, Fisheries and Food, Pest Infestation Control Laboratory, London Road, Slough SL3 7HL, England).

The moisture content/equilibrium relative humidity relationships at 15, 25 and 35°C, for unextracted rice brans from Burma and Tanzania,



unextracted bran from a South African parboiled rice, and a pelleted extracted rice bran from India, are presented and discussed. The relationships differed in shape and position of the curves, and in the magnitude of hysteresis between adsorption and desorption. The equilibrium moisture contents at 65% R.H. and below, of Burmese, Tanzanian and Indian brans were in reverse order of their fibre and ash contents. These moisture contents did not decrease consistently with oil content as they did for those cereal grains and oilseeds previously investigated. The hysteresis for the parboiled bran was less, and the equilibrium moisture content was generally lower than for the other brans. For all brans tested the equilibrium moisture content at c. 70% R.H. fell within a range of 9 - 13%.

SHAHEEN, A.B., EL-DASH, A.A. and EL-SHIRBEENY, A.E. 1975. Effect of parboiling of rice on the rate of lipid hydrolysis and deterioration of rice bran. Cereal Chem., 52 (1), 1-8, 2 tabl, 3 fig, 12 ref. (Authors' address: Department of Food Technology, Al-Azhar University, Cairo, Arab Republic of Egypt).

Two rice varieties, one short grain (Nahda) and one long grain (Arabi) were parboiled with either a soaking or a boiling treatment prior to steaming: the effect of these treatments on the rate of lipid hydrolysis during long-term storage was then investigated. Parboiling of rice reduced the development of free fatty acids (ffa) in the bran oil. Although the bran of parboiled rice can be stored as long as 10 months with only slight deterioration, the bran of untreated rice cannot be stored for more than 1 month without serious deterioration of oil and bran quality. Unparboiled bran exhibited two distinct stages of hydrolysis, an initial rapid rate for the first 7 weeks of storage and a subsequent slower rate throughout the remainder of the storage period. This latter stage was independent of variety. The long grain variety showed a lower rate of lipid hydrolysis for both parboiled and untreated samples than a short-grain one, although preboiled, parboiled samples showed greater lipolysis of bran oil than presoaked parboiled ones. The value of the parboiling process in reducing the rate of ffa increase is partially offset by loss in resistance to oxidation, as was evident from an increase in the peroxide value for the parboiled samples.

STIRLING, H.G. 1974. Warehouse design for durable produce in the non-humid tropics with particular reference to coffee storage in Kenya. Kenya Coff., 39 (465) 353-365, 5 graph, 5 photo, 10 ref. (Author's address: Coffee Board of Kenya, P O Box 30566, Nairobi, Kenya).

A description is given of experiments to assess the effectiveness of traditional tropical warehouse design in producing a suitable



environment for storing produce. The limitations of such design are discussed, and some suggestions for improvements which have shown promise when tested on scale models are put forward. In particular a double skinned roof and controlled ventilation were found to be effective. These modifications are being incorporated on a prototype basis in a full scale coffee warehouse near Nairobi and some details are given.

STIRLING, H.G. 1975. Further experiments on the factors affecting quality loss in stored arabica coffee. <u>Kenya Coff., 40</u> (466), 28-35, 1 tabl, 1 fig, 5 graph, refs. (Author's address: Coffee Board of Kenya, P O Box 30566, Nairobi, Kenya).

Describes further experiments following initial studies on quality loss of stored parchment arabica coffee under sealed conditions. These new experiments compare the differences between storing parchment, pre-hulled and clean coffees, and examine the effects of ventilated storage over a 12 months period, at five different temperatures. Rates of quality loss are presented graphically, and it is concluded that ventilated storage, under appropriate temperature and humidity conditions, is an effective method of quality preservation.

SUTTON, H.M. and SCHOFIELD, C. 1974. A systems approach to in-plant bulk handling. <u>Bulk Storage Movement Control</u>, <u>1</u> (1), 22-23, 1 fig. (Authors' address: Warren Spring Laboratory, Stevenage, Herts., England).

Problems and inefficiencies that occur in bulk handling usually arise from a failure to consider the system as a whole. Some details are given of work which has been done on new methods for designing bulk solids plant so as to take in all the relevant constraints in a systematic way, aiming at providing a satisfactory solution rather than an optimal one.

TAYLOR, R.W.D. 1975. Fumigation of individual sacks of grain using methallyl chloride for control of maize weevil. <u>Int. Pest Control</u>, 17 (1), 4-8, 6 tabl, illus, 14 ref. (Author's address: Tropical Stored Products Centre (TPI) Ministry of Overseas Development, Condon Road, Slough SL3 7HL. England).

Points out the disadvantages of carbon tetrachloride and ethylene dibromide, and describes tests on methallyl chloride as a possible alternative for in-bag fumigation of grain. Polythene-lined sacks containing 66 kg yellow maize at c.13% m.c. were artificially infested with Sitophilus zeamais and treated with liquid methallyl chloride at rates of 7 ml, 10 ml, 15 ml and 20 ml per bag, and unfumigated



controls were kept with them over a storage period of 7 days. All bags were stored at 27°C and 70% R.H. and gas samples were taken at regular intervals at three points in each bag and analysed for gas concentrations. At the end of the fumigation, the entire contents of the bags were sieved and adult insects, live and dead were Sounted. In later tests whole sacks were retained for incubation in order to ascertain the numbers of surviving insects. indicated that the methallyl chloride distributed rapidly, and after some 4 hours the concentrations were at similar levels at all sampling points. The 7 ml dosage appeared to give insufficient C x T products to kill all the more resistant stages of the insect but 10 ml was apparently sufficient to kill all stages. Preliminary tests in the laboratory indicated that a similar dosage will control all stages of Tribolium castaneum an maize and Acanthoscelides obtectus on haricot beans. Dissipation of methallyl chloride from the grain after treatment was slow, but residue levels fell below Dopm after one weeks airing, and grinding and cooking considerably lowered these levels.

TECHNICAL ADVISORY SUB COMMITTEE. 1974. Condensation in containers. An interim report. ICHCA Publ. No 4 9/74. 18 pp, illus, res, 2 append. (Publ. International Cargo Handling Coordination Assocation, Central Office, Abford House, 15 Wilton Road, London SWIV 1LX. Price £10.00)

Makes a brief examination of the factors affecting condensation in containers, including the containers themselves, the cargo, hygroscopic and non-hygroscopic commodities. Selected case histories include canned goods, cocoa, coffee, hides and skins. There are octes on materials, used for packaging, separation and securing, with special reference to fibreboard, timber and fibrous materials. The effects of climatic and other changes en route, such as storage near to heated or chilled bodies, are examined, and the importance of correct storage in the container is discussed. Methods of prevention include mechanical dehumidifiers, dessicants, processed packaging material, ventilation, pre-drying of cargo, dunnage and packaging, pre-drying of containers, moisture absorbent paints, pallet covers, purging of the atmosphere with nitrogen. Normal moisture contents of a few selected commodities are listed in an appendix.



UNITED NATIONS: FOOD AND AGRICULTURE ORGANIZATION. 1975. Report on the first course of the FAO/SIDA/Tanzania Sub-Regional Training Centre on storage pest control. Swedish Funds-in-Trust, TF AFR 49 (SWE), FAO/SWE/TF 144. v + 28 pp, 8 append. Rome: UN:FAO, Via delle Terme di Caracalla 00100-Rome, Italy.

The course was attended by 22 participants from Tanzania, Kenya, Uganda, Somalia, Zambia, Botswana, Ethiopia and Seychelles. Its objectives were to reinforce for participants a basic understanding of the factors affecting grain storage losses and instruction in techniques for their control, and to provide experience in teaching and extension of this subject. It was based on the faculty of Agriculture and Forestry of the University of Dar-es-Salaam at Morogoro. Visits were made to several stores in various areas of Tanzania. The course covered the whole range of storage types, from farmer, through trader, middle level and large-scale stores (except for silo managment). Syndicate and discussion work was Tesigned to direct participants' attention towards their own countries' storage problems. An assessment of the effectiveness of the course, both by participants and staff, was initiated.

WINKS, R.G. 1974. Characteristics of response of grain pests to phosphine. CSIRO Div. Ent., A. Rep. 1973-74. (Abstract only) (Author's address: Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, P O Box 1700, Canberra City, A.C.T. Australia 2601).

Although phosphine has been used extensively as a grain fumigant its toxicity to insects has not been well understood. Laboratory investigators have reported conflicting results and the view has Seen expressed that phosphine is an atypical poison in that the response to it is not governed by a concentration x time relationship characteristic of many other poisons. Detailed investigation of response characteristics of Tribolium castaneum has revealed that the response is dependent on concentration. The investigation included an evaluation of time as a response factor, time as a losage factor, the narcotic effect of phosphine (see below) and its effect on the reproductive capacity and longevity of survivors. At low concentrations (0.005 to 0.5 mg/l) phosphine behaves like other poisons and a concentration x time relationship has been established. At concentrations in excess of 0.5 mg/l, however, a narcotic effect confers a degree of protection to the exposed peetles, most probably by reducing the intake of poison. The response characteristics undergo a marked distortion, the tolerance is increased and there are significant levels of sublethal injury to survivors.



WINKS, R.G. 1974. Fumigant resistance studies. CSIRO, Div. Ent. A. Rep. 1973-74, 38-39. (Abstract only). (Author's address: Commonwealth Scientific and Industrial Research Organization, Division of Entomology, P O Box 1700, Camberra City, A.C.T. Australia 2601).

The recent world-wide survey of pesticide resistance in stored grain insects indicates that low levels of resistance to methyl bromide and phosphine have arisen in field populations of some of the major grain pests. Resistance to methyl bromide and phosphine has also been selected in several laboratory strains of stored grain pests. Studies indicate that phosphine resistance may be obtained after relatively brief selection pressure. Thus, a 10-fold increase in resistance was obtained in a laboratory strain of Tribolium castaneum following 6 generations of selection with phosphine. However, although resistance has been increased in this strain, survivors from dosages producing more than 50% mortality produced few progeny. Phosphine resistance may occur as a result of an enhanced detoxication mechanism, a decrease in the susceptibility of the target enzyme systems, or as a result of more intense or more rapid narcosis. The degree of protection afforded by narcosis in a susceptible strain of T. castaneum was found to increase with increasing phosphine concentration. Thus, in strains exhibiting increased narcotic response, high levels of phosphine resistance may be obtained. The practical implications of this are clear. Should strains of this type occur in field populations, low, non-narcotic concentrations, with longer exposure periods, will be required to achieve control.

The editor regrets that he is unable to supply reprints or photocopies of items abstracted. For this reason the names and addresses of authors are given whenever possible, to enable readers requiring further information to apply direct.

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1975

Tropical storage abstracts

A selection of recent abstracts relevant to the storage of durable agricultural produce in the tropics.

Issued by the Tropical Stored Products Centre (Tropical Products Institute), LIBRARY London Road, Slough, SL3 7HL, Buckinghamshire, England.

MYSORE-2A

Editor: J. R. O. Humphries, M.A.

4 NOV 1975





AMARITSUTH, W., AMARITSUTH, W. and KNAPP, F.W. 1974. Stored grain insect studies. 1. Susceptibility of the bean and rice weevil to three insecticides. 2. Resistance of mung bean and sorghum seed to laboratory infestations of bean and rice weevil. Thai J. agric. Sci. 7 (1), 63-70. (Authors' address: Northeast Agricultural Centre, Kohn Kaen, Thailand).

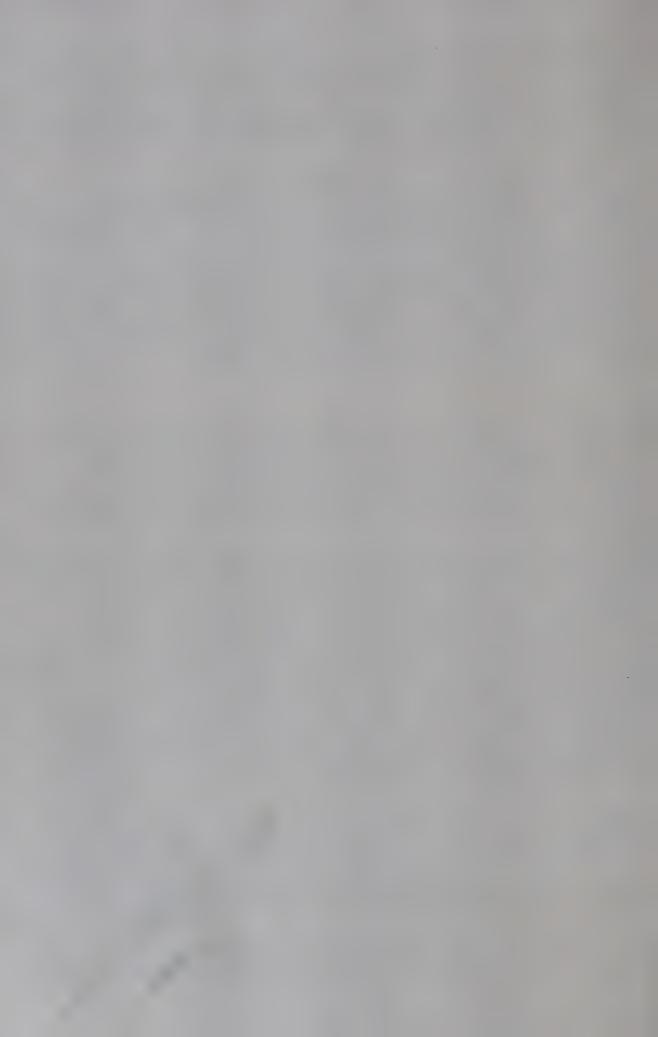
Dursban was found to be more effective than malathion in protecting mung bean (Phaseolus aureus) and sorghum (Sorghum spp.) from the bean weevil (Acanthoscelides obtectus) and the rice weevil (Sitophilus oryzae), respectively, and malathion was more effective than DDT. Seed germination was not affected by these treatments. Two varieties of mung bean, Black seed and Golden M-B, were found to be significantly more resistant to the bean weevil than was the local variety. Noticeable differences in resistance to rice weevil were found among the sorghum varieties, but only two were significantly less resistant than the common Hegari variety now being grown.

ARAULLO, E.V., NESTEL, B. and CAMPBELL, M. (Ed.) 1974. Cassava processing and storage. Proc. interdisciplinary Workshop, Pattaya, Thailand, 17 - 19 April 1974. 125 pp, figs, ref. ISBN 0 88936 036 7. Publ. International Development Research Centre, Box 8500, Ottawa, Canada K1G 3H9. Price, microfiche ed. \$1.00.

Individual papers are given in full, together with abstracts. Most aspects of the cassava industry are discussed. Among others are: Phillips, T.P., World market prospects for cassava and its products; Booth, R.H. and Coursey, D.G., Storage of cassava roots and related post-harvest problems; Tulanada, D., Problems of the Thai tapioca trade; Hrishi, N., Problems and prospects in cassava production in India; Castillo, L.S., The cassava industry of the Philippines; Wijeratne, W.B., Cultivation, processing and utilization of cassava in Sri Lanka; Manurung, F., Technology of cassava chips and pellets processing in Indonesia, Malaysia and Thailand; Nguyen Cong Thanh, Technology of cassava chips and pellet processing in Thailand.

BANKS, H.J. and SHARP, A.S. 1974. Gas interchange in freight containers. Symp. 1st int. Working Conf. stored Prod. Ent. Oct. 7-11 1974. Savannah, Georgia, USA. (Abstract only). (Author's address: Commonwealth Scientific and Industrial Research Organisation, Division of Entomology, P O Box 1700, Canberry City, A.C.T., Australia 2601).

Factors leading to gas interchange between container and external atmosphere are detailed and their relative significance discussed.



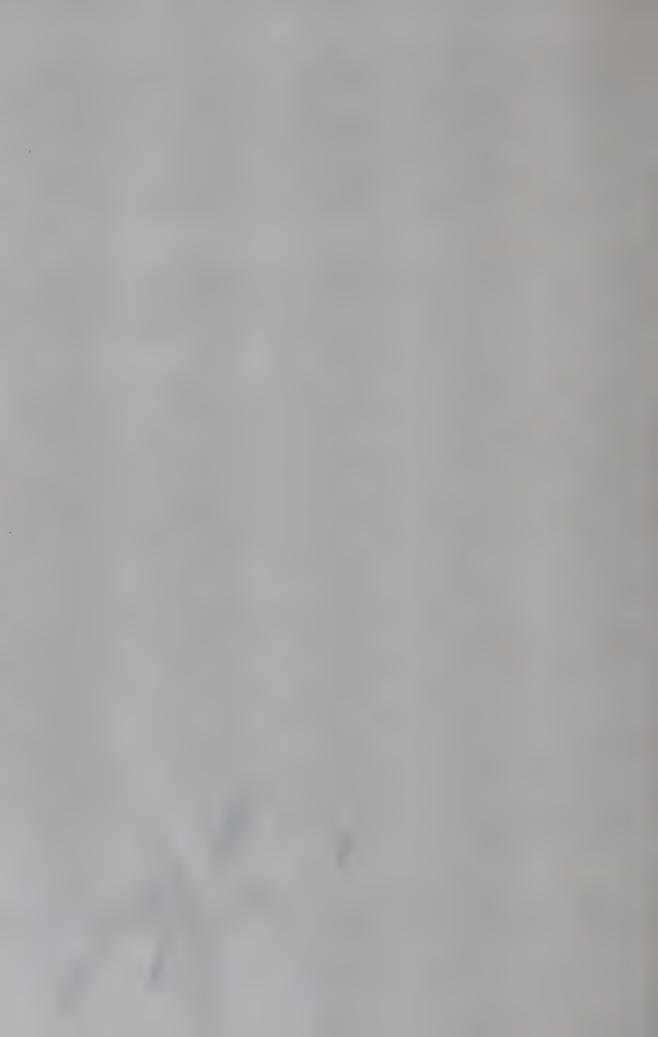
An approximate quantitative value is given for various ambient conditions and container leakiness. Under poor sealing conditions through flow phenomena such as caused by wind are dominant. Under more gastight situations cyclic phenomena became important (e.g. diurnal temperature variation). Equivalent hole sizes for a range of containers are presented which can be used for prediction of the interchange rate; the influence of hole size is discussed in relation to fumigation and ventilation of commodities in containers.

BOND, E.J. 1974. The future needs and developments for control of stored-product insects. Symp. 1st int. Working Conf. stored Prod. Ent. Oct. 7-11, 1974. Savannah, Georgia, USA. (Abstract only). (Author's address: Research Institute, Canada Department of Agriculture, London, Ontario, Canada).

The control of pests in stored products is of great importance because it is during the storage and processing stage that food materials have their greatest value in terms of time and effort spent on production. Future methods for control of pests in stored food should put greater emphasis on prevention of infestation through improved storage conditions and better handling methods. Legislation that would require stringent sanitation in commodities and transportation carriers moving through world commerce seems to be one potential method of confining population and reducing insect infestation. At the present time chemicals are being used in many places to compensate for inadequate storage and poorly designed facilities that lead to infestation problems. Chemical control is, and perhaps always will be essential, but it must be closely integrated with all other aspects of food handling and processing to achieve maximum protection of the product. An in-depth assessment of previous research in methods and approaches in pest control of stored products should be made to select the type of research that has been most productive and profitable. With the advent of resistance of chemicals in stored product insects a thorough knowledge of both resistance mechanisms in the insects and the mode of action of the chemicals becomes of paramount importance. An outline of some current work in studies on the response of pests to chemicals and the action of the chemicals on pests is given.

BROOKER, D.B., BAKKER-ARKEMA, F. and HALL, C.W. 1974. Drying cereal grains, vi + 265 pp, tabls, illus, refs. index. Publ. AVI Publ. Co. Inc. Westport, Connecticut, USA. Price \$ 24.00.

There are nine chapters, with the following titles: principles of grain drying; moist air properties; grain quality deterioration;



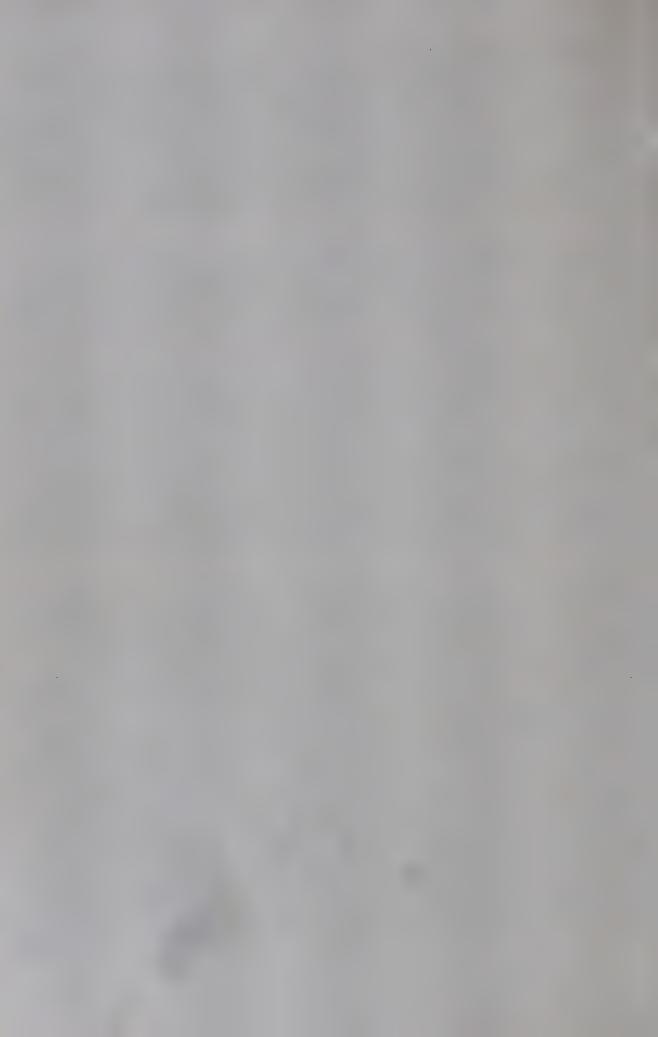
grain equilibrium moisture content; air movement; introductory analysis of fixed bed drying systems; grain drying systems; theory and simulation of cereal grain drying; controls for dryer operation and safety. Each chapter is provided with figures and bibliography, and the appendices give basic data including: grain physical properties; grading; heating value of fuels; methods of determining air flow; conversion data; mathematical models concerning psychrometrics and grain drying; climatic data for the USA.

BUHL, C., WEIDNER, H. and 20GG, H. (Editors). Krankheiten und Schadlings an Getreide und Mais. Ein Bestimmungsbuch. (Diseases and pests of grain (wheat, barley, rye, oats) and maize. A determination book). Stuttgart: Verlag Eugen Ulmer, 19752, 431 pp. (Germ.). Price unknown.

Part 1 covers diseases and pests on living plants in the field.
Part 2 covers diseases and pests in stored grain. The first section gives identification keys based on pest symptoms in the grain. The second section provides keys for the identification of insects, both adults and larvae, and covers some primitive species, e.g. Lepinotus, Liposcelis, as well as the more common Coleoptera and Lepidoptera. There is a table for the recognition of mites (e.g. Acarus, Tyrophagus, Glycyphagus, Cheyletus etc.) A key for the identification of rodents covers Rattus norvegicus, R. rattus Mus musculus domesticus and M. musculus musculus.

CONWAY, J.A. 1974. Investigations into the origin, development and control of <u>Caryedon serratus</u> (Ol.) (Col. Bruchidae) attacking stored groundnuts in The Gambia. Symp. 1st int. Working Conf. stored Prod. Ent. Oct. 7-11, 1974, Savannah, Georgia, USA. (Abstract only). (Author's address: Crop Protection Unit, Dept. Agric., Yundum Experimental Station, Western Division, The Gambia).

Caryedon serratus (Ol.) (Col. Bruchidae) is a pest of major significance to the groundnut industry and hence to the Gambian economy. Heavy attack takes place in two forms of storage, seed nuts in bag and trade nuts in bulk. Previous control work had been aimed at protecting nuts in store against C. serratus attack. The work described established that nuts coming into store were invariably already infested in the field and the scale and distribution of this initial infestation was determined for all areas. A sequence of primary host species supporting C. serratus throughout the year was identified and the possibilities of suppressing C. serratus populations via the primary hosts in groundnut growing areas was examined. This work is continuing. The development of C. serratus



populations in seed and bulk stores was studied with the areas of heaviest insect attack in large bulks of nuts being shown to be at variance with previous laboratory findings. Migration of fourth instar larvae in both bag and bulk stores was found to be a common phenomenon with nuts in the vicinity of suitable pupation surfaces suffering heavy attack. Elimination of the intake infestation by fumigation using phosphine or methyl bromide was shown to be the ideal as the need for residual insecticides is obviated. This is now the standard technique for all seed on agricultural stations and commercial farms and the entire confectionery groundnut production. Where fumigation was not possible a range of insecticides was evaluated together with alternative application techniques for bag and bulk storage. A crude admixture of malathion at 10 ppm gave very good control of C. serratus in large bulks for 16 weeks at a cost of 40 bututs per metric ton treated. Pirimiphosmethyl, lindane, phoxim, and iodofenphos were inferior to malathion at the same rate. Malathion at 20 ppm gave excellent control of C. serratus in bagged seed nuts at a cost of 6 bututs per 57 kg bag. (£1.00 = 4 Dalasi = 400 bututs).

DEUSE, J.P.L. and POINTEL, J.G. 1974. Assessment of research at farm level storage in Francophone Africa. 1st int. Working Conf. stored Prod. Ent. Oct. 7-11, 1974. Savannah, Georgia, USA. (Abstract only). (Authors' address: Institut de Recherches Agronomiques Tropicales (IRAT), Crop Prot. Divn. 110, Rue de l'Universite, Paris, 7 eme, France).

The losses caused by stored products insects reduce the amount of available food and its nutritional value. This is particularly important in West Africa where the quantity of foodstuffs is hardly enough to assure food for all the population. IRAT has therefore oriented its research principally towards post harvest protection in view of improvement of groundnut storage, groundnuts being the principal cash crop of West Africa. Protection of cowpeas and maize have equally been improved in Senegal and in Togo. In West Africa it has been shown that pre-storage damage during drying and threshing, was important and influenced greatly the losses incurred during storage. Research has been carried out to modernize methods of storage. The farmer has already been introduced to low cost maize cribs, plastic bags in which a capsule of carbon tetrachloride was used for insect fumigation, and oil drums. Studies have also been carried out to develop a three-ton capacity bin which responds to the peasants' needs. Finally studies of irradiation for insect control in dried fish in Mali have permitted the introduction of a practical method by irradiation but the method is still rather costly.



ESMAY, M.L. and HALL, C.W. (Ed.). 1973. Agricultural mechanisation in developing countries. xi + 221 pp, tabls, illus, ref. Publ. Sales Dept., Shin-Norinsha Co Ltd., 7-2 Chome, Kanda Nishikicho Chiyoda-Ku, Tokyo, 102, Japan. Price \$9.00

The eight chapters comprise: principles of agricultural mechanisation; mechanisation in Equatorial Africa; in Asia; in Latin America; ownership patterns for tractors and machinery; drying, storing and handling food grains in developing countries; irrigation; education and training for agricultural mechanisation. The chapter on drying and storing (Chap. 6 by Merle L. Esmay) covers the following: objectives; terminology; food grain losses; second generation problems; factors influencing storage and transportation; distribution and utilization of food grains; farmers' organisations; storage principles; drying principles; mechanical drying systems; a proposed flat bed batch dryer for paddy rice; storage requirements; grain storage; storage design; storage summary; storage programme recommendation; transportation; guide lines. Each chapter has a summary and a list of selected references.

FRIENDSHIP, R. 1975. Insect pest control and haricot beans. Ethiopian Grain Rev., 2 (1), 10-13, 4 pl. (Author's address: P O Box 3721, Addis Ababa, Ethiopia).

Points out that haricot beans are among Ethiopia's major foreign exchange earners and that to maintain their price they must be protected from damage caused by <u>Acanthoscelides obtectus</u>. A brief description is given of the insect's life history and of the damage it causes. Pest control measures are limited to fumigation under gas-proof sheets and the application of residual insecticides. The use of chlorinated hydrocarbons is banned by overseas importers, and premium grade malathion is recommended for spraying of buildings and for spraying of bagged produce prior to fumigation. Notes for the future include further research into the insect's behaviour pattern and pre-harvest infestation, improvements in storage hygiene and more efficient inspection methods including inspection to ensure that ships loading cargoes of beans are infestation free.

GILES, P.H. and LEON, O.V. 1974. Infestation problems in farm-stored maize in Nicaragua. Symp. 1st int. Conf. stored Prod. Ent. Oct. 7-11 1974, Savannah, Georgia, USA (Abstract only). (Authors' address: Seccion de Productos Almacenados (SEPRAL), Ministry Agric. and Livestock, Apartado 592, Managua, Nicaragua).

Maize, a most important staple crop in Nicaragua, is largely produced on small farms and stored as unhusked ears in wooden granaries, although sometimes small quantities of shelled grain are kept.



Heavy damage, estimated nationally at 15 per cent each year, occurs due to attack by stored-product insects which are listed according to distribution and relative occurrence. Results of trials are presented on methods of reducing these losses by early harvesting, selection of less susceptible varieties, storing ears without the husk and treating with insecticide dusts (lindane, malathion, pirimiphos-methyl, and tetrachlorvinphos) and the storage of shelled grain in plastic film bags and metal drums with or without fumigants (aluminium phosphide, carbon tetrachloride/ethylene dichloride).

GOLOB, P. and NICHOLS, W. 1975. The design and development of the TPI produce inspection sieve. Rep., Trop. Prod. Inst. No L.42 iv + 10 pp, 3 tabl, 4 fig, 1 pl, append. ISBN: 0 85954 0391 Price £0.30. (Gratis to official bodies in developing countries). (Authors' address: Tropical Products Institute, 56/62 Grays Inn Road, London WCIX 8LU, England).

Describes the development of a sieve which deals with large samples of a commodity, i.e. whole sacks. It eliminates in-sack variations in factors such as broken grain, insects and dust, which often occur in isolated pockets. Some advantages claimed are: that the sieve permits a visual inspection of the commodity in each sack; a composite sample may be taken by hand from all parts of the commodity as it flows over the sieve; dust, broken grains, etc. can be collected and weighed as an indication of the degree of damage; insects can be isolated, and very small numbers, e.g. 5-10 insects per sack can be detected. The apparatus consists basically of a hopper, an interchangeable mesh agitated by a hand-driven eccentric, and a receiver for dust and other small particles such as insects and broken grain. A specially designed sack barrow can be used for moving the sieve. Tests of the sieve using coffee beans are described. An average 60 kg sack could be sieved in 2 min. 20 sec. Optimum conditions included a gap of 1.5 cm between the hopper and the mesh and a cranking rate of 70 r.p.m. It is concluded that satisfactory results were obtained with coffee, and that the sieve would probably perform equally well with other commodities.

HIGHLAND, H.A. 1975. Tricalcium phosphate as an insect suppressant in flour and CSM. J. econ. Ent., 68 (2), 217, 219, 2 tabl, refs. (Author's address: Stored Products Insects Research and Development Laboratory, Agric. Res. Serv., USDA, Savannah, GA 31403, USA).

When large quantities of CSM (a blend of maize meal, soya flour, dry milk, vitamins and minerals) containing 2% tricalcium phos-



phate were shipped from the United States to South America, the tricalcium phosphate suppressed the development of large populations of Tribolium castaneum (Herbst), the principal insect found in the CSM, during 6 and 7 months of storage in heavily infested warehouses. Tricalcium phosphate in similar quantities of flour suppressed the development of large populations of T. castaneum, Rhyzopertha dominica (F.), Lasioderma serricorne (F.), Tenebroides mauritanicus (L.) and an unidentified moth.

KAMEL, A.H. 1974. Storage pests. Proc. 1st FAO/SIDA Semin. Improv. Prod. Field Fd Crops Pl. Sci. from Afric. and Near E., Cairo, Egypt. 1-20 Sept. 1973, 1974. 585-593, 5 ref. (Author's address: Dr Abdel Hakim Kamel, Director, Stored Products Pests Research, Ministry of Agriculture, Dokki Giza, Arab Republic of Egypt).

Begins with a brief description of main storage facilities in Egypt, comprising: 'Shounas' - areas of land, enclosed by walls or fences and usually uncovered; underground storage - sand ditches and pits; room-type stores usually of unbaked bricks; mud and chaff built bins of 1 - 15 tons capacity; terminal elevators. Emphasizes need for a grain storage programme. Brief notes are given on insects attacking stored cereals, leguminous seeds and flour and milled products. Sources of infestation are discussed, and recommended control measures include store hygiene, residual insecticide sprays on store fabric, dusting of stacks, and fumigation of infested stacks using carbon disulphide, hydrogen cyanide, methyl bromide or phosphine. There are also notes on rodent pests - seven species are named, and recommendations for control include proofing, inspection, baiting, fumigation and store hygiene. Recommendations are also made for control of bird pests - mainly sparrows.

LA HUE, D.W. 1975. Pirimiphos methyl as a short term protectant of grain against stored-produce insects. J. econ. Ent. 68 (2), 235-236, 2 tabl, ref. (Author's address: Grain Marketing Research Centre, Agric. Res. Serv., USDA, 1515 Collège Avenue, Manhattan, KS 66502, USA).

Pirimiphos methyl, applied as a water emulsion (5, 10 and 20 ppm) to hard winter wheat and shelled yellow maize killed all exposed adult Sitophilus oryzae, Tribolium castaneum, T. confusum and Rhyzopertha dominica at 24 h and 1 month after treatment; no F₁ progeny developed. After 3 months, a few T. castaneum and T. confusum survived exposed to grain treated with 5 ppm but no progeny developed. In addition some R. dominica survived and F₁ progeny and damage were recorded in wheat treated with 5 ppm and in maize treated and 5 and 10 ppm. Malathion, applied at a calculated dosage of 10 ppm as the chemical standard, gave complete



protection to both grains for 3 months. The residues of pirimiphos methyl degraded gradually as the storage period lengthened except for the 20 ppm applied to the shelled maize. The residues of malathion degraded gradually on both grains.

LOCKWOOD, L.M. 1975. Small scale storage and drying of paddy in Bangladesh, the scope for reducing losses. Rep. TVS/CORR Grain Storage Project, Jalchatra, Tangail District, Bangladesh. duplic, ii + 20 pp, refs. (Author's address: Appropriate Technology Cell (Storage and Handling), Bangladesh Agricultural Research Council, 130-C, Road 1, Dhanmandi, Dacca, Bangladesh).

The Government of Bangladesh has given high priority to the programme to increase food production within the country. An important feature is prevention of post harvest losses, and advance planning for storage and handling of increased yields. A brief review is given of available literature on losses in Bangladesh. There are notes on current storage practices. storage problems, and some suggestions are made for possible improvements in storage practices. The principles of grain drying are examined, and current practices in Bangladesh, their problems, and possible improvements. Mention is made of difficulties in introducing methods of small scale drying. There are notes on grain treatment for small scale storage, including phosphine fumigation, fumigant mixtures, admixture of inert and insecticidal dusts, spraying and hermetic storage. Some economic aspects of proposed changes in drying and storage are examined, and the need for more detailed and reliable field data on current practices and losses is emphasised.

LOCKWOOD, L.M. 1975. Solar cabinet dryers for drying grain and other agricultural produce in Bangladesh; preliminary report.
Rep. IVS/CORR Grain Storage Project, Jalchatra, Tangail District, Bangladesh. duplic, i + 8 pp, 2 tabl, 1 fig, refs. (Author's address: Appropriate Technology Cell (Storage and Handling), Bangladesh Agricultural Research Council, 130-C, Road 1, Dhanmandi, Dacca, Bangladesh).

In the introduction, the various theoretical advantages of solar dryers are discussed, and possible arguments against their introduction in Bangladesh are examined. A study was undertaken to construct and test a model solar cabinet dryer, and the report describes the model, gives details of design and cost, and examines various possible applications. It is concluded that the dryer is unlikely to be of much practical use in drying food grain, because of limited capacity and economic factors, but it may be of value



in drying seed grain. The possible use of solar dryers for preserving fruit and vegetables is examined in some detail, but their acceptability for general purposes is considered to be still in question.

McCALLUM-DEIGHTON, J. 1974. The control of stored products insects with pirimiphos methyl. Symp. 1st int. Working Conf. stored Prod. Ent. Oct. 7-11 1974. Savannah, Georgia, USA. (Abstract only). (Author's address: ICI Plant Protection Ltd., Jealott's Hill Research Station, Bracknell, Berks. England).

Pirimiphos-methyl, 2-diethylamino-6-methylpyrimidin-4-yl dimethyl phosphorothionate, a broad spectrum insecticide with a mammalian LD50 > 2000 mg/kg, is being developed for use against insects attacking stored produce. The lowest doses of pirimiphos-methyl giving complete kill of susceptible and malathion-resistant strains of insects are approximately the same as those for fenitrothion, but lower than those for malathion, bromophos, iodofenphos, tetrachlorvinphos, or dichlorvos. This relative order of effectiveness is unchanged when comparing the lower doses which allow some adults to lay eggs but kill the resultant progeny. Of all the insecticides tested, only gamma-BHC was as effective against Rhyzopertha dominica as against the other insect species used. Pirimiphos-methyl will protect grain from insect attack and will also eradicate infestations of the larvae of primary grain insects. It has good claims to be considered, in some respects, uniquely suitable as a stored product insecticide.

PREVETT, P.F. 1974. Tecnologia de graos armazenados - alguns melhoramentos recentes. (Grain storage technology - some recent developments). Bolm Inf. Soc. Bras. Cienc. e Tecnol. Alimentos, No 30, 1974, 1-21, 20 ref. (Port.) (Author: FAO Food Storage Expert, ITAL, Campinas, Brazil: present address: Tropical Stored Products Centre, London Road, Slough SL3 7HL, England).

Discusses the problem of food storage losses in general and gives an estimate for Brazil. Points out the importance of pre-storage factors. Considers the storage of produce in sacks, and building requirements such as insulation, controlled ventilation, provision for in-store fumigation, and instances use of an impervious ceiling in East Africa. The use of a time-controlled space sprayer using dichlorvos for control of Ephestia cautella is mentioned. Plastic sheeting as cover over bagged dry produce can act as a barrier against insect attack. Sacks themselves are vulnerable to insects, and by permitting passage of moisture vapour may lead to mould growth, so that alternative sacking materials of film and woven plastics are being considered. For bulk storage, modern vertical



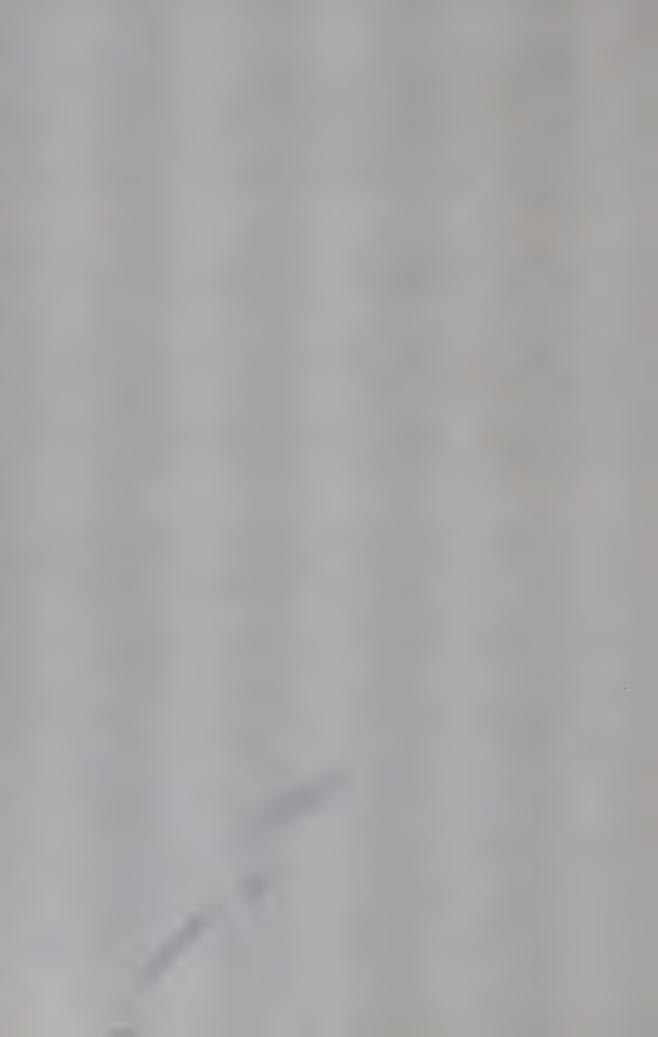
silos offer few problems of insect control, but horizontal silos are less satisfactory, and direct admixture of insecticides with the grain seems to offer the most satisfactory solution. Brief notes are given on hermetic storage, including storage in plastic container underwater, and storage of damp grain. Other methods include aeratic and the use of propionic and other acids. Finally, emphasis is placed on the need for adequate training of personnel applying modern storage techniques.

ROBERTS, D.E. and BROOKER, D.B. 1975. Grain drying with a recirculate Trans. Am. Soc. agric. Engnrs, 18 (1), 181-184, 2 tabl, 5 fig, 6 ref. (Author's address: D E Roberts, Engineer, Goldkist Cooperative, Atlanta, Ga. USA).

Report on laboratory scale experiments on a recirculatory drying process. The results are examined mathematically using 9 basic equations. Conclusions reached are that, in the given laboratory conditions, 1. with recirculation drying the entire bed of grain is dry after one complete cycle; 2. some re-wetting does occur with this method, but the net effect of re-wetting is negligible; 3. the mathematical model presented predicts satisfactorily the recirculation drying process.

SCHULTEN, G.G.M. 1974. Pesticides and post-harvest control. Lect. 12th int. Summer Course Industrialisation, 9 August 1974, The Hague, Netherlands, duplic. 22 pp, refs. (Author's address: Department of Agricultural Research, Royal Tropical Institute, 63 Maurtiskade, Amsterdam-Oost, The Netherlands).

A general review of storage problems. The various forms of losses are examined and there is a brief discussion on the assessment of losses in storage. The effect of moisture is noted, and the maximum moisture contents for safe storage of a number of selected commodities e.g. maize, paddy, cowpeas, are given. The most important stored products insect pests are listed and there is discussion of infestation by insects and mites. There are notes on micro-organisms and mycotoxins, and on the common rodent pests. Storage methods for unshelled produce are mentioned, as well as underground storage and airtight storage. There is a general discussion on pesticides. and specific notes on malathion, lindane, pyrethrins, dichlorvos and the use of inert materials. The importance of the CT product in fumigation is emphasised, and there are notes on the use of methyl bromide, phosphine, and liquid fumigants. Other pesticides mentioned are the acute and chronic rodenticides, and the fungicide propionic acid. Finally it notes that the development of resistance to pesticides and even to fumigants has been demonstrated in a recent world survey carried out under the auspices of the FAO.



SETH, A.K. 1974. Use of Actellic for stored rice insect problems in S.E. Asia. Symp. 1st int. Working Conf. stored Prod. Ent. Oct. 7-11 1974. Savannah, Georgia, USA. (Abstract only). (Author's address: Asia and Africa Department, Plant Protection Ltd. Fernhurst Haslemere, Surrey. England).

Trials evaluating pirimiphos-methyl, a new wide spectrum organophosphorus insecticide with low mammalian toxicity, against pests of stored rice in S.E. Asia are described. The experiments discussed here were concerned with the admixture of insecticide with grain and also the external treatment of hessian sacks used for storing rice. For the treatment of external surfaces of the sack an application of 250-500 mg a.i./m pirimiphos methyl controlled all insect pests entering the sacks for up to six months after treatment. Pirimiphos methyl combines a strong fumigant effect with a lasting contact activity. In Malaysian trials the standard malathion treatments at equivalent and higher rates were ineffective against the main pest Tribolium castaneum suggesting development of resistance to this chemical. Pirimiphos-methyl was also found to give effective and prolonged control of other pests, e.g. Oryzaephilus surinamensis, Sitophilus oryzae, Ephestia kuhniella, Rhizopertha sp. and Sitotroga cerealella.

SINGH, R.H. and BENAZET, J. 1974. Chemical intervention on all stages and on all scales of tropical storage practice. Symp. 1st int. working Con. stored Brod. Ent. Oct. 7 - 11 1974, Savannah, Georgia, USA. (Abstract only). (Authors' address: International Institute of Tropical Agriculture, Tbadan, Nigeria).

Grain protection has been in practice for centuries in the tropics. Earlier protection included use of materials such as ash and dry neem leaves, which probably acted as an abrasive and repellent respectively. In the late 1940's, the concept of synthetic chemical control was established and spread during the 1950's. It gradually transformed from mixing of BHC and DDT dust to the use of approved products such as malathion and Phostoxin. During this period research on relative efficacy of various chemicals and fumigants under tropical storage conditions was also conducted. Grains need protection at all stages from field to consumption. In the tropics field to storage infestation by stored grain pests is common. Inadequate storage methods immediately after harvest and before processing add to the problem of field to storage infestation. The process of infestation and more so of multiplication of insects continues during processing, transportation, and long term or seasonal stoage before the grain is finally consumed. Yield losses during these various stages are estimated. An overall yield loss of 30%, as estimated by some workers, may



not be an exaggerated estimate. Storage practices in the tropics variable a great deal due to factors such as climate, produce, availability of local materials, transportation, length of time to be stored. There has been a great deal of change in storage practices at government level, where large scale storage is practised, but comparatively little change has come at the level of the tropical subsistence farmer.

SINHA, R.N. 1974. Climate and the infestation of foodstuffs by pests. 1st int. Working Conf. stored Prod. Ent. Oct. 7-11 1974, Savannah, Georgia, USA. (Abstract only). (Author's address: Research Station, Canada Department of Agriculture, Winnipeg, Manitoba, Canada).

Climate plays an important if not crucial role in determining whether cosmopolitan pests of stored foodstuffs will become established in a food-storing region of the world. Using a recognized climatic classification of regions where major cereal and food crops are produced, the characteristic patterns of infestation of storage insects and mites predominant in these regions are examined. Heterogeneity of species distribution and variation in insect density corresponding to diversity of climatic conditions within a region, such as in Kenya in East Africa and Uttar Pradesh in India are emphasized. The climatic conditions during harvest of various wheat producing regions are analysed and considered an important factor in setting the pattern of post-harvest deterioration of stored grain. Laboratory data on physical limits of Sitophilus, Rhizopertha, Sitotroga, Cryptolestes and other major storage pests were correlated to climatic data of selected regions to postulate certain basic patterns of distribution and infestation of major storage insect pests. How the basic relationships between climate variables and infestation records can be used to predict potential insect outbreaks is illustrated by a deductive multivariate analysis of 3 years' insect infestation data from 41 crop districts in the Canadian Prairies.

UNITED NATIONS: FOOD AND AGRICULTURE ORGANIZATION, AGRICULTURAL SERVICES DIVISION. 1974. Measures for reducing post harvest losses. Supporting paper for the World Food Conference Preparatory meeting, Rome, Italy, 23 September - 4 October 1974. AGS: Misc/74/5, duplic, 9 pp. Rome: UN:FAO.

Discusses post harvest grain losses which occur during drying, storage, processing, transport handling and distribution. The advantages and disadvantages of effecting improvement at farm level and low and medium level commercial operations are compared, and examples are quoted from rice production records in India and Liberia. The areas selected for priority in improvement proposals



are Asia and the Far East, and Africa South of the Sahara. Recommendations are outlined for improvements at the various post harvest stages. Finally a list is given of policy decisions which will have to be taken.

UNITED NATIONS: FOOD AND AGRICULTURE ORGANISATION: INSTITUTE OF FOOD TECHNOLOGY, SENEGAL 1974 La conservation et l'entreposage des arachides (The conservation and storage of groundnuts). Based on the work of I. Pattison. AGS: SF/SEN 5. Rapport Technique 10. 43 pp + 10 photos. (Fr.). (Obtainable from: UN:FAO, Distribution and Sales Section, Via delle Terme di Caracalla, OO100-Rome, Italy).

Caryedon serratus attack on groundnuts and groundnut seed causes considerable losses every year in this valuable export crop, Senegal being the world's second largest expoerter after Nigeria. Present control methods which include spraying of stores, insecticide treatment by layers in groundnut stacks and fumigation within a store are all unsatisfactory. Control operations should be aimed at the level of the co-operative groundnut seccos. An homogenous admixture of lindane should be applied to the seccos; tests have shown that lindane leaves residues that are well under the tolerance limits established by the legislation of importing countries. Stacks of seed groundnut can be successfully fumigated under sheets, before entering the store. For the future it is worth considering the construction of fumigable stores for groundnut seed, as total disinfestation of small stacks is easy and will be less onerous than treatment with insecticide.

VARDELL, H.H. 1975. Effect of multiple fumigation on residues in flour. J. econ. Ent. 68 (1), 69-70, 2 tabl, refs. (Author's address: Stored Products Insects Research and Development Laboratory, Agric. Res. Serv., USDA, Savannah, Georgia 31403, USA).

Pallet-sized plywood containers holding forty-eight 50 lb bags of flour were fumigated with methyl bromide. These fumigations at 15.6, 21.1 and 26.7°C were repeated until the 125 ppm tolerance for inorganic bromide on the flour was reached or exceeded. The inorganic bromide residues increased with an increase in fumigation temperature even though the methyl bromide dosage was decreased. About 3, 4 and 5 methyl bromide fumigations of flour can be made at 26.7, 21.1 and 15.6°C respectively, without exceeding residue tolerance.



WEAVING, A.J.S. 1975. Grain protectants for use under tribal storage conditions in Rhodesia - 1. Comparative toxicities of some insecticides on maize and sorghum. J. stored Prod. Res., 11 (2), 65-70, 7 tabl, 13 ref. (Author's address: Ministry of Agriculture, Department of Research and Specialist Services, Salisbury, Rhodesia).

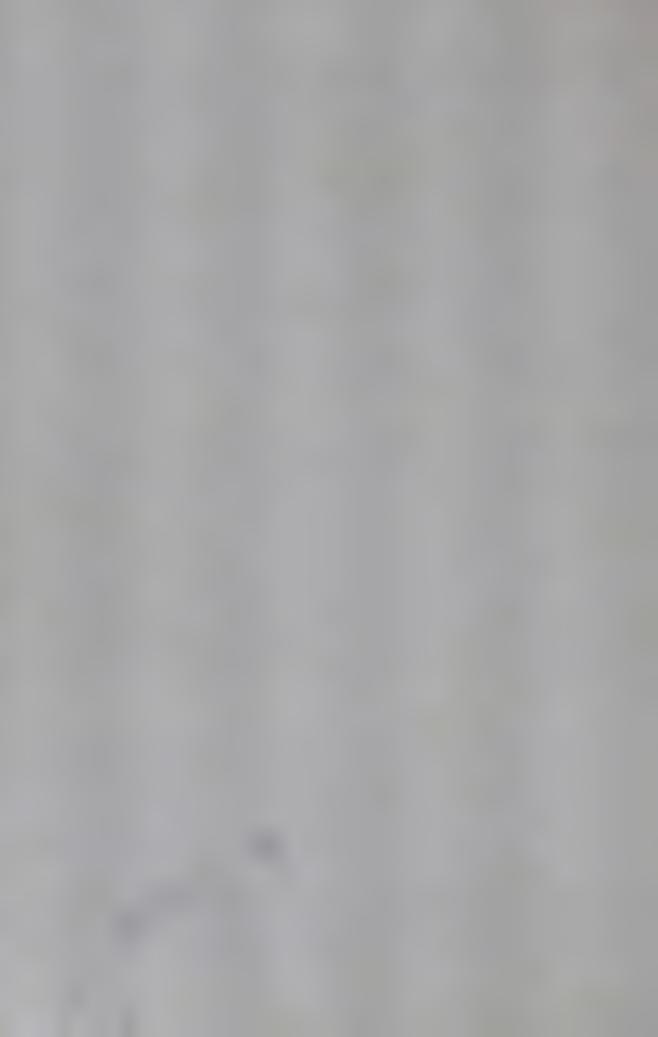
Median lethal doses of five insecticides were measured for <u>Sitophilus</u> <u>zeamais</u> on maize and sorghum using laboratory formulated dusts. Fenitrothion was the most toxic followed by fenthion, iodofenphos, tetrachlorvinphos and pyrethrins in order of decreasing toxicity. Fenitrothion on maize and sorghum (8.0 ppm), pirimiphos methyl on maize (5.0 ppm) and phenthoate on maize (4.0 ppm) showed good persistence for 12 months, other insecticides tested giving shorter periods. The optimum pyrethrins:piperonyl butoxide ratio was 1:15, smaller ratios demanding a higher deposit of pyrethrins than is normally recommended. Loss of insecticidal effect was more rapid on maize than on sorghum though responses to given doses of insecticide were less on the latter grain.

WHEATLEY, P.E. 1974. Research being undertaken by the Tropical Stored Products Centre in the United Kingdom and Overseas. <u>EPPO Bull.</u>, <u>4</u> (4), 495-500. (Author's address: Tropical Stored Products Centre, Tropical Products Institute, London Road, Slough SL3 7HL, England).

Research is undertaken by the Centre both overseas and in the United Kingdom on storage problems facing developing countries. Much of it is of a strictly applied nature although some longer-term basic studies are also underway. Brief notes are given on current work on biological, chemical and engineering studies at all levels of storage, from farm to central storage depot, on a wide range of durable agricultural products and associated pests. Reference is also made to the Centre's publications, and to the various training programmes.

WHITNEY, K.W. 1974. A general survey of physical means for control of storage pests. Symp. 1st int. Working Conf. stored Prod. Ent. Oct. 7-11, 1974. Savannah, Georgia, USA. (Abstract only). (Author's address: Cyanamid International, Princeton, New Jersey, USA).

Storage pest control by physical means is the oldest method known and is still one of the most important. This survey deals with the following topics: current agronomic practices as related to storage; physical exclusion of pests; addition of chemically—inert solids; modification of the storage atmosphere; modification of moisture and temperature; physical impact such as turning and use of the Entoleter; radiation such as sound, visible light, UV, IR, radio-frequency and ionizing radiation; host-plant resistance;



integration and interactions of physical control methods with other methods; and the future propsects for physical control.

ZETTLER, J.L. 1975. Malathion resistance in strains of <u>Tribolium castaneum</u> collected from rice in the USA. Short Commun.

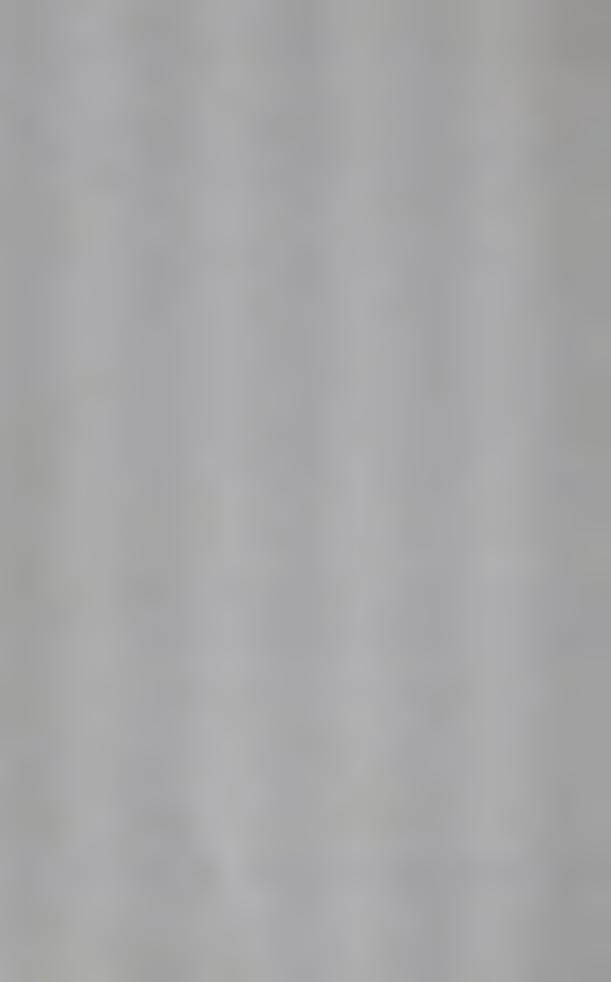
J. stored Prod. Res., 11 (2), 115-117, 1 fig. 7 ref. (Author's address: Stored Products Insects Research and Development Laboratory, Agric. Res. Serv., USDA, Savannah, Georgia 31403, USA).

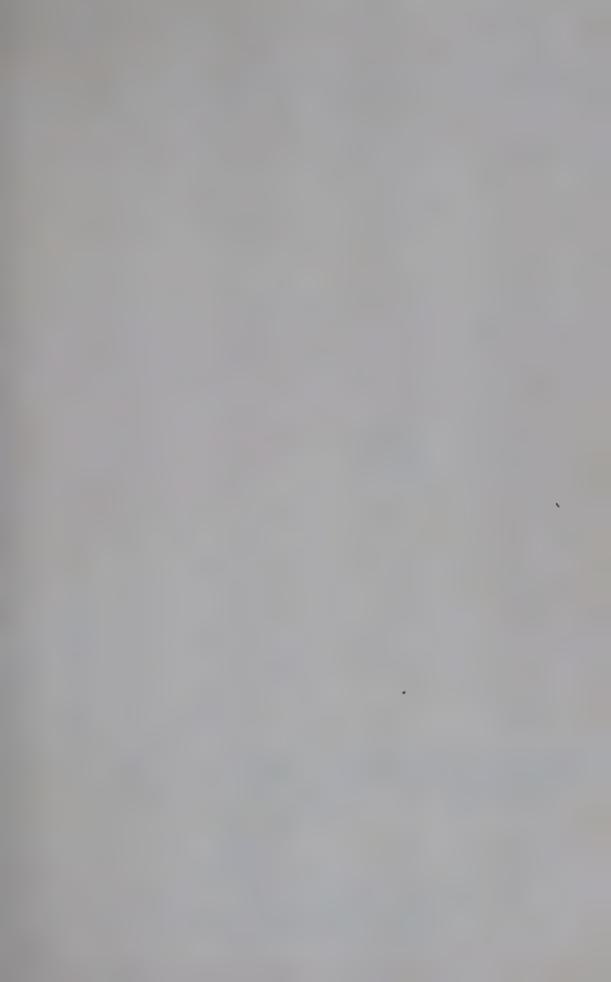
Adults of \underline{T} , castaneum were collected from rice mills and storage facilities in Texas and Louisiana in 1973, and maintained in laboratory cultures at $27 \pm 1^{\circ} C$ and $60 \pm 5\%$ RH. Adults of the F_2 generation were tested for malathion resistance. High levels of resistance were found in strains both from port facilities and also from storages at mills. Whilst strains at ports might have developed cross resistance, the supposition is made that strains from mills were endemic, and resistance had resulted from malathion control programmes in the stored rice. The results of the test suggest that malathion resistance in \underline{T} . castaneum is becoming widespread and serious and may lead to control failures if malathion is continued in use. The findings indicate the need for research on alternative insecticides and on the cross resistance characteristics of resistant strains.

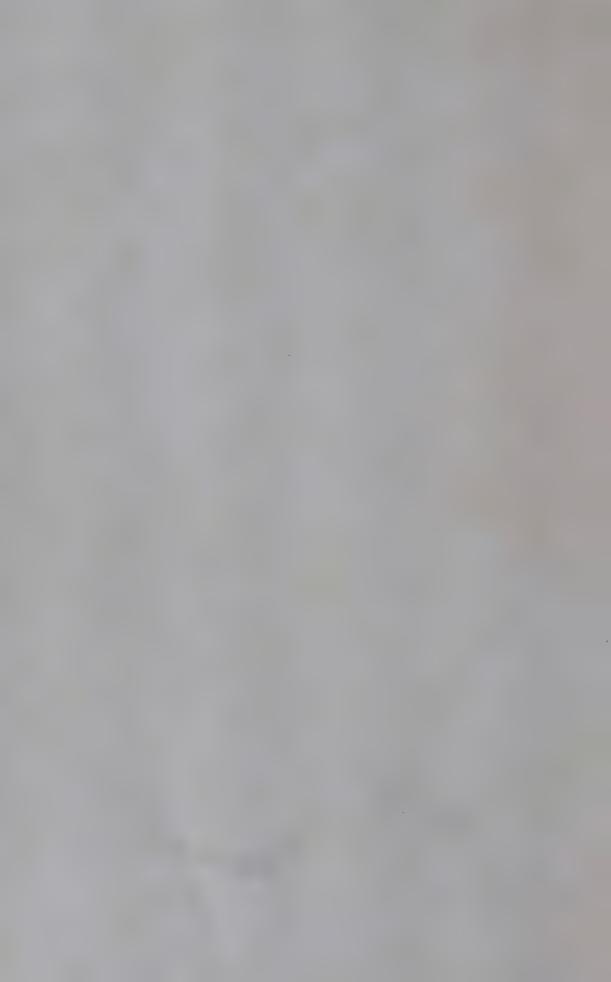
The editor regrets that he is unable to supply reprints or photocopies of items abstracted. For this reason the names and addresses of authors are given whenever possible, to enable readers requiring further information to apply direct.

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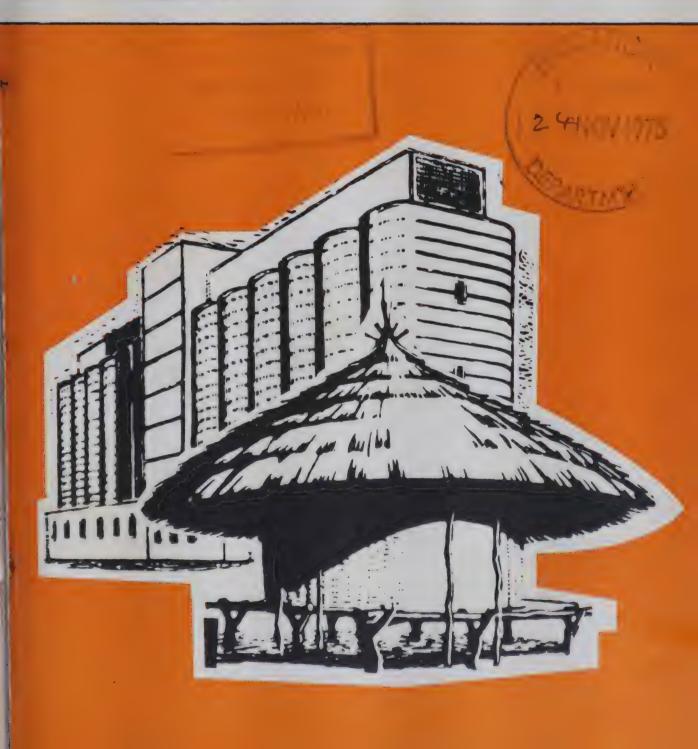


Tropical storage abstracts

A selection of recent abstracts relevant to the storage of durable agricultural produce in the tropics.

Issued by the Tropical Stored Products Centre (Tropical Products Institute), London Road, Slough, SL3 7HL, Buckinghamshire, England.

Editor: J. R. O. Humphries, M.A.





ANON. 1975. FAO/WHO pesticides residue tolerances for food grains. Pesticides, India, 9 (2), 33-34, tabl.

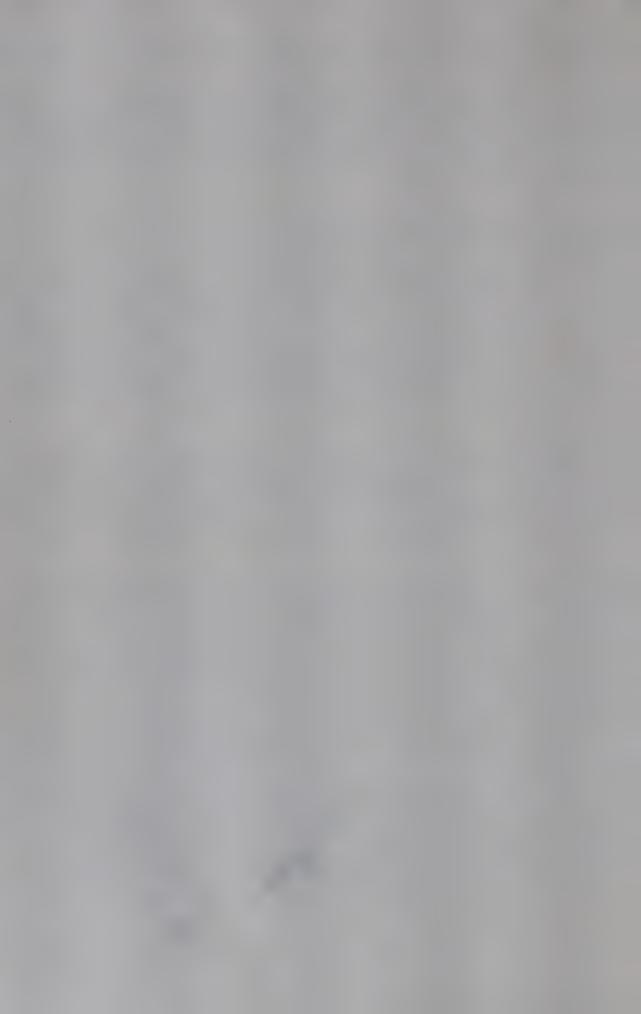
Lists residue tolerances recommended by the FAO Working Party of Experts on Pesticide Residues and the WHO Expert Committee on Pesticide Residues. Details given include name of pesticide, maximum acceptable daily intake (mg/kg body weight), tolerance, special remarks.

ANON. 1975. Tropical crop processing, drying and storage equipment. Wld Crops, 27 (5), 207-209, 211-214, 216.

Gives names and addresses of suppliers of equipment suitable for use in warm climates. Some details are given of types available, such as processing rate, power requirements, capacity. Machines mentioned include threshers, coffee pulpers, shellers, separators, hullers, coffee grinders, rice hullers and milling machinery, maize shellers, crop driers. Brief notes are given on a number of crop storage silos and animal feed silos.

BANDYOPADHYAN, M.K. 1975. Studies on the hermetic storage of paddy for the control of <u>Sitotroga cerealella</u> (Lepidoptera: Gelechiidae). Ph.D. Thesis, Indian agric. Res. Inst., <u>Ent. Newsl.</u>, India, <u>5</u> (2), 9-10. (Summary only). (Division of Entomology, Indian Agricultural Research Institute, New Delhil 110012, India).

Reports on laboratory investigations on the susceptibility of the immature stages of S. cerealella to airtight storage and the effect of airtight storage on paddy and storage fungi associated with it. Paddy of 14, 16 and 18% m.c. was stored at 25, 30 and 35°C. Eggs were not killed at 15% m.c. and below, but 100% mortality was recorded in paddy at 18% m.c. stored at 30-35 when the oxygen content had fallen to 0.6%. First instar larvae were killed in paddy at 14% m.c. when oxygen concentration fell to 3%, whilst in grain of 16 and 18% mortality only occurred when oxygen content fell to 0.24%. Fourth instar larvae and pupae were killed under all conditions when oxygen concentration fell to 0.21%. The relative susceptibility to airtight storage was in the descending order first instar larva, fourth instar larva, pupa. Desiccation was also a factor affecting mortality in airtight conditions. Deteriorative changes in paddy were not eliminated by hermetic storage, but were related to moisture content and temperature. Fungal growth was retarded.



BARRE, H.J. and WIMBERLEY, J.E. 1975. Storage of food grains in South Asia. Pap. presented 1975 A. Mtg. Amer. Soc. agric. Engrs, Davis, California, June 22-25, 1975. No 75 - 4506, 11 pp, 1 tabl, 8 fig, 18 refs. (Author's address: H J Barre, Profressor Emeritus of Agricultural Engineering, Ohio State University, Ohio Agricultural Research and Development Centre, Columbus, Ohio, USA).

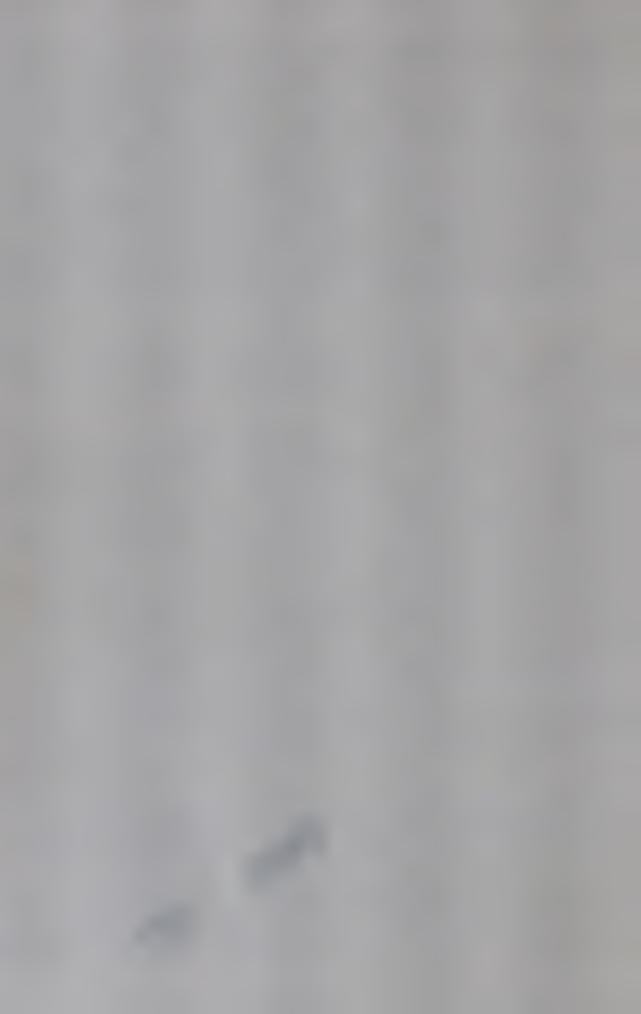
Progress in better handling and storage methods for food grains in South Asia is being made. Most indigenous home storage methods are ineffective and costly. A simple metal bin will preserve dry grain for an indefinite period without loss and at low cost. Conversion of bag to bulk warehouse storage is finding acceptance. This highly developed method can be readily adapted for countries with hot and dry or hot and humid climates.

BEARD, R.L. 1974. Termite biology and bait-block method of control. Connecticut agric. Exp. Sta. Bull. No 748, 19 pp, 5 tabl, 9 fig. refs. Publ. The Connecticut Agricultural Experiment Station, New Haven, Connecticut, USA).

Emphasises the importance of biological studies in devising suitable control methods. The maintenance of experimental termite cultures is described, and there are notes in the various members of a typical colony, including soldiers, nymphs, and mature and immature breeding forms. Other notes include the development of a colony, feeding patterns and foraging, and natural control by parasites and predators. The bait-block method of control employs poisoned blocks of wood. The poison is a proprietary formulation, mirex, and the blocks are subjected to partial decay by the fungus Gloeophyllum trabae, to render them more attractive to the termites. The results of various tests are discussed. The poison is taken up by foraging termites and lethal doses are ultimately distributed throughout a colony. The technique is simple and successful, and provided minimal quantities of poison are used, natural control agents are not threatened. The most suitable application is for the control of discrete existing or developing colonies.

BIELORAI, R. and ALUMOT, E. 1975. The temperature effect on fumigant desorption from cereal grain. <u>J. agric. Fd Chem.</u>, <u>23</u> (3), 426-429, 6 tabl, 7 refs. (Authors' address: Agricultural Research Organization, The Volcani Centre, Bet Dagan, Israel.

The more rapid desorption of fumigant residues from whole cereal grain at low (14-17°C) rather than at high (30-37°C) temperature was confirmed with several fumigants by two methods of analysis. The unchanged fumigant residues seem to be present in the fumigated



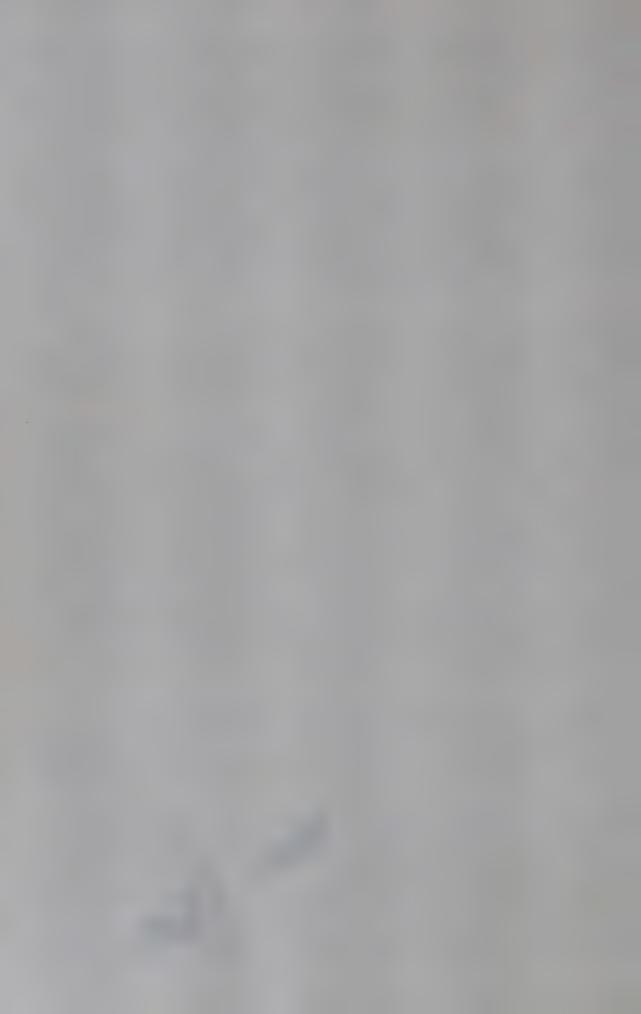
grain in two forms; loosely and firmly bound. The desorption of the firmly bound residues from grain fumigated at room temperature is at least twice as fast at low rather than at high temperature of airing. Fumigation temperatures affect the relative amounts of the residues: at lower temperatures lower levels of firmly bound residues are present. This temperature effect may be responsible for faster desorption in the winter than in summer as noted in field experiments. This could have a bearing on the airing period required after fumigation in hot as compared with temperate climates. The low temperature effect was abolished by grinding the grain and was not due to the fat fraction of the fumigated material. It seems that the intact grain structure is responsible for this effect.

DEASON, D. 1975. Adequate cleaning a problem. Proper drying important. Rice J., 78, (5), 22. (Author's address: Dr D Deason, Agricultural Engineer, Louisiana State University Cooperative Extension Service).

Recommended guide lines for a good bin drying system are given and include: a good air flow; a source of heat; proper controls; cleaning system to remove foreign matter. Rice harvested at 22% m.c. can be dried easily to a depth of 8 ft. The air_delivery system should be capable of providing a minimum of 2.5ft /min/bu. at a static pressure of 3 in. water. Roof openings should be at least 1 ft per 15000 ft /min. of air volume. Heat requirements are moderate, and a temperature rise of 12 F above ambient is adequate. High quality controls are essential, and should include both thermostats and humidistats. Finally, thorough cleaning to remove trash, weed seeds and other foreign materials must be arranged if maximum performance is to be obtained, and spoilage of grain in store is to be avoided.

DELOUCHE, J.C. and BASKIN, C.C. 1973. Accelerated ageing techniques for predicting the relative storability of seed lots. Seed Sci. Technol., 1 (2), 427-452, 7 tabl, 3 pl, 6 fig, biblphy. (Authors' address: Mississippi State University, State College, USA).

Points out that although most seed parcels of the same kind, variety, and age have roughly the same germination percentage, they do not all store equally well under the same conditions, and this has important economic results. Several methods have been developed for evaluating the relative storage potential of seeds. The most successful method involves accelerated ageing, at temperatures of 40-45°C and 100% R.H. for periods up to 10 days, depending upon the species and variety. Results from a 6 year



study involving many lots of 16 different seed kinds show that germinative responses after accelerated ageing are closely correlated with responses in storage under a variety of conditions for periods up to 3 years. A number of response reactions of seeds indicating their storage potential are discussed.

DICHTER, D. (Ed.) 1975. West African Seminar on the volunteer role in grain storage. Cotonou, Dahomey, December 13-21, 1974. 249 pp, tabls, figs, ph, biblphies, (Engl.). (Publ. The German Agency for Technical Cooperation L d. (GTZ), Press and Public Relations Office, D-6236 Eschborn 1 - P O Box 5180, West Germany). (Price unknown).

Report on a seminar designed to produce a document of immediate practical utility. The main body of the report consists of selected working documents and manuals from the seminar, followed by questions and answers of a practical nature. Cassette tapes and slide strips are being made available covering the main points, including the on-the-job instructions phase. Working papers presented include:

LINDBLAD, C., NEWMAN, M. and VINITA, R. Problems related to popularising new farm-level grain storage technology.

THORSHAUG, H. Construction and utilisation of various farm and village-level grain storage facilities.

PO SUP CHUNG and PEDERSEN, J.R. Fundamentals of farm and village level grain storage.

ADESUYI, S.A. The appropriate application of insecticides to farm and village level grain storage.

KETE, L. Socio-economic aspects of grain programmes at the village level.

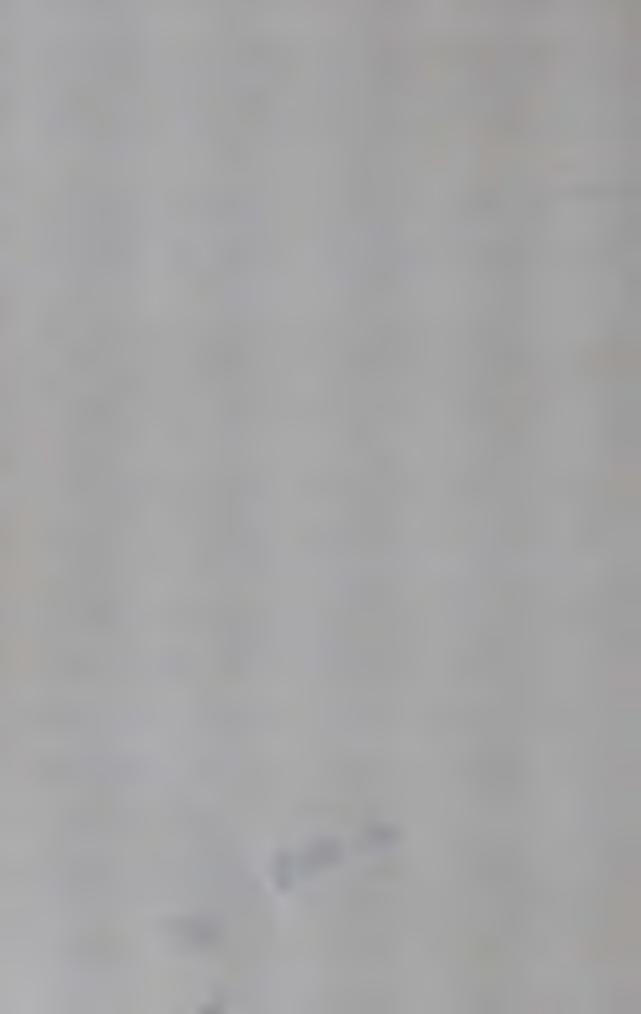
POINTEI, J.-G. Farm and village level grain storage techniques other than silos.

NTITI, E.O. Rural grain cooperatives: their management and administration.

EAO/IITA. Worksheet for the building of a drying/storage crib.

US PEACE CORPS/MINISTRY OF RURAL DEVELOPMENT AND COOPERATIVE ACTION, REPUBLIC OF DAHOMEY. Construction manual for the 4.5 ton and 2.5 ton cement-stave silo and the mud-walled grain dryer.

contd....



US PEACE CORPS/MINISTRY OF RURAL DEVELOPMENT AND COOPERATIVE ACTION. Instructions for the use of your silo and dryer.

RIGTERS, K.A. Grain storage silo developed by field staff (Northern Ghana). Comparative costs of improved farm and village-level grain storage structures.

Section III covers implementation of improved systems.

FEDERATION FRANCAIS DES CEREALES. 1975. Ravageurs des graines entreposees. (Pests of stored grain). (Extract from the booklet, 'Les cereales a la cooperative' (Cereals and the cooperative). Bull. anc. Elev. Ec. Meun., 1975 (268), 211-214, 12 fig. (Fr.)

A brief description is given of the main insect pests of grain, with illustrations of the insects and the damage caused. Insects involved comprise Sitophilus granarius, S. oryzae, Tribolium confusum, Oryzaephilus surinamensis, Tinea granella, Plodia interpunctella and Sitotroga cerealella. Precautions against infestation include store hygiene - use of an industrial vacuum cleaner is recommended, fabric spraying with insecticide and separation from wooden floors, if necessary by plastic sheeting. There are notes on causes of infestation, losses, and insecticides in use, with special reference to lindane, malathion and pyrethrins. Malathion is suggested as the insecticide of preference. Fumigation with methyl bromide or phosphine is mentioned only briefly and the danger is emphasised. Other control methods noted include thorough drying, and cooling by ventilation.

FRANCE: SECRETARIAT D'ETAT AUX AFFAIRES ETRANGERES, 1974. Manuel de conservation des produits agricoles tropicaux et en particulier des cereales. (Techniques rurales en Afrique). (France: Secretariat of State for Foreign Affairs, Manual of Storage of tropical agricultural products, particularly cereals. (Rural techniques in Africa). Cent. Etud. Exp. Mach. agric. trop. (C.E.E.M.A.T.) 356 pp, 184 fig, 5 append, biblphy. (Fr.) (Publ. C.E.E.M.A.T., Parc de Tourvoie, 92160 Antony, Haute de Seine, France. Price £4.50).

Consists of three principal parts. The first deals with general problems and discusses factors affecting the spoilage of stored produce such as microorganisms and moisture, insect pests and rodents. Methods of conservation discussed include drying, ventilation, pest control. The second deals in greater detail with drying and storage, at both traditional and commercial levels. The third concerns equipment and management at main storage centres, and gives some estimates of the economics of storage. Appendices give details of moisture relations, principal pests, ventilation factors, and some principal suppliers of equipment. Finally, eight crops including maize, rice and grain legumes are discussed in detail.



FREEMAN, J.A. and PILTZ, H. 1975. Storage pests: list of dangerous pests in commodities particularly liable to infestation. Pl. Hlth Newsl., EPPO Publ. Ser. B. No 80, 9-18, 3 tabl, (Eng. Fr.). (Author's address: Pest Infestation Control Laboratory, London Road, Slough, Berks. SL3 7HL, England).

Notes the addition to the list of noxious insects of Tenebroides mauritanicus and Oryzaephilus mercator. Trogoderma granarium is added to the list of insects subject to quarantine procedure. Lists of commodities are divided into those particularly liable to moderate or heavy infestation, and those which are regularly highly infested.

GIBBONS, R.W., LAURENCE, R.C.N., NORSE, D. and COX, R.A.J. 1975. Groundnut drying trials in Malawi. <u>Trop. Sci. 17</u> (1), 15-24, 4 tabl, refs. (Authors' address: Grain Legume Research Laboratory, Agricultural Research Council, P O Box 215, Lilongwe, Malawi).

Stripping groundnuts from the haulms at lifting and spreading the pods on mats was the most efficient method of drying groundnuts rapidly to prevent fungal contamination. Sheltering is advocated at night and if rain showers occur. Otherwise, unstripped haulms are best left inverted in the windrows until completely dry or until required labour is available. Mycological investigations showed that fungal invasion was strongly correlated with pod breakages caused by insects or harvesting implements. The main groundnut producing areas of Malawi have favourable weather conditions under which rapid and safe curing of the groundnut crops can be achieved.

HUTCHINSON, J. (Chairman). 1975. British aid and the relief of malnutrition. Report of the ODA advisory committee on protein. Minist. Overseas Dev., Overseas Dev. Pap. No 2, ISBO 0 11 580165 0, vi + 44 pp. London: HMSO. Price 51p net.

The terms of reference of the committee were to advise on the scientific, economic and other relevant aspects of problems of the production and consumption of conventional and non-conventional protein foods and supplements with particular reference to the needs of developing countries, bearing in mind the relationship between protein supplies and calorie requirements. The committee finds that protein deficiency in diet is directly related to general malnutrition and poverty. The basic recommendation made is that in the interests of better nutrition aid should be directed to projects that will generate income among the poor, even where such projects do not have any marked effect on the national income of the country concerned. Other recommendations relate to the provision of personnel with nutrition expertise, suitable training and job



opport nities for trained personnel, and increased attention to less productive farming areas and poorer farmers. Finally the report emphasises the importance of food technology, storage, marketing and distribution in developing countries in reducing the effects of food shortages.

JACOBSON. M. 1975. Insecticides from plants. A review of the literature, 1954-1971. USDA, Agric. Res. Serv. Handb. No 461. Publ. Superintendent of Documents, US Government Printing Office, Washington DC 20402, USA. Price \$2.00.

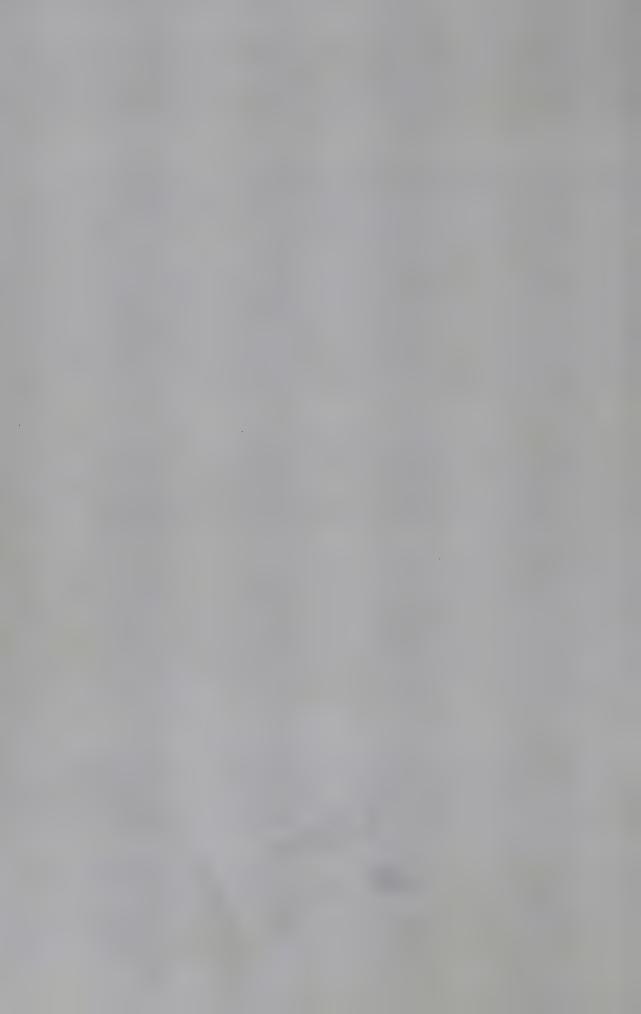
Plants from which insecticides are derived are grouped by families. 1485 species are represented. No attempt has been made to include material on the well-known plant insecticides pyrethrum, rotenone, nicotine and ryania. Powdered kernel of neem, Azadirachta indica is an active protectant of wheat seed against Sitophilus oryzae, Rhizopertha dominica and Trogoderma granarium for up to 12 months when mixed at a rate of 1-2 parts per 100 parts of wheat.seed.

JOSHI, G.P. 1975. Uben die Abhangigkeit der Eizal und Entwicklung des Getreideplattkafers Oryzaephilus mercator Fauv. (Col., Cucujidae) von der Nahrung. (On the dependence of the oviposition and development of the grain beetle Oryzaephilus mercator on food supply). Anz. Schadlingskde, Pflanzenschutz, Umweltschutz, 48 (8), 119-120. (Germ.)

Oryzaephilus mercator showed very considerable variation in egglaying on different dry fruit meals (apricot, cashew, almond, groundnut, coconut, fig, date and raisin). The lowest egg period was 4.1 days on almond and the highest on apricot 5.1 days. The egg mortality on various meals differed to a small extent (11.8 to 14.1%). The larval period ranged between 22.7 to 34.3 days. The larval mortality ranged between 7.8% on almond to 94.4% on raisin.

KEM, T.R. 1975. Studies on the development of resistance to phosphine in <u>Tribolium castaneum</u> (Herbst). Ph.D. Thesis, Indian agric. Res. Inst., <u>Ent. Newsl.</u>, India, 5 (2), 6-7. (Summary only). (Division of Entomology, Indian Agricultural Research Institute, New Delhi - 110012, India).

The thesis reports the results of investigations carried out in the laboratory on the selection of a phosphine-resistant strain of <u>T. castaneum</u> and its cross-resistance characteristics. By selection over ten generations, a strain was obtained which was 11.95 times more resistant than the normal susceptible strain.



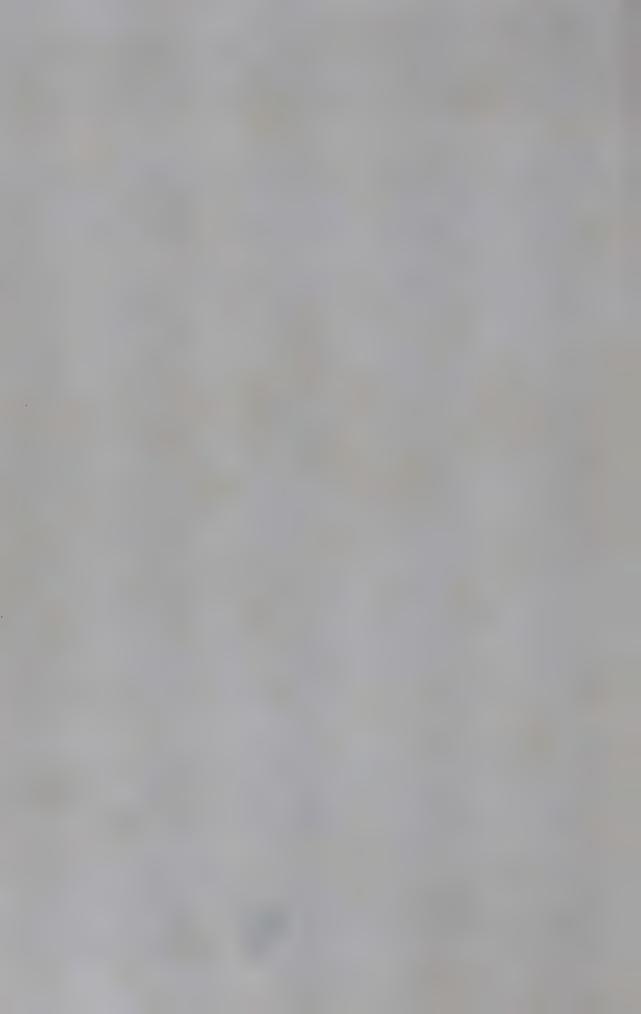
Bioassay tests with other fumigants did not reveal cross-resistance to EDCT mixture, ethylene dichloride, carbon tetrachloride, carbon disulphide, ethylene dibromide or methyl bromide. No cross resistance was observed in tests with eleven insecticides which included malathion, iodofenphos and pyrethrins.

LA HUE, D.W. 1975. Evaluating Gardona and malathion to protect wheat in small bins against stored grain insects. Mktg. Res. Rep., US Dep. Agric. No 1037, iii + 12 pp, 20 tabl, 1 fig, ref. (Author's address: US Grain Marketing Research Centre, Agricultural Research Service, USDA, Manhattan, Kansas, USA).

Low volume (LV) spray and drip on applications of malathion, an ultra low volume (ULV) application of Gardona, and a formulation of malathion in granular carbon were compared as protective treatments against insect attack to wheat stored in small bins for 12 months. Damaging infestations of mixed populations of stored grain insects developed in all untreated control bins during the first 4 months of storage from insects released in the storage room. The LV malathion emulsion spray and the malathion granular carbon application gave excellent protection for 12 months. Malathion residues recovered from the different LV replicates were fairly consistent for each ageing period. The residue gradually declined from 4.5 to 1.5 ppm during the 12 month period. More malathion residue was found in samples with the granular application, but greater variation in ppm occurred between replicates. Unsatisfactory residue patterns were found in many analyses of wheat treated with the LV drip-on emulsion. Samples from 3 of the 5 bins showed deposits far below the desired amounts whilst one bin had an excess of residue. Protection against insect attack varied accordingly. Gardona residues, which averaged 6.16 ppm 24 hours after treatment, decreased rapidly during the first 2 months of storage to an average of only 1.78 ppm. Sufficient residues remained, however, to protect the wheat against insect attack in the bins for 8 months.

LE CATO, G.L. 1975. Species composition influencing insect population growth and weight loss of stored rice, wheat and corn. J. Kansas ent. Soc., 48 (2), 224-231, 4 tabl, 6 refs. (Author's address: Stored-Product Insects Research and Development Laboratory, Agric. Res. Serv., USDA, Savannah, Georgia 31403, USA).

Various combinations of species of stored-product insects influenced their population growth and weight loss of whole kernels of rice, wheat or maize. Cryptolestes pusillus, Oryzaephilis surinamensis and Tribolium castaneum produced more offspring and caused more weight loss in grain when each was associated with Rhizopertha dominica or Sitophilus oryzae.



LIPTON, M., COOK, I. and NAIR, N. 1974. Cost-benefit analysis of crop storage improvements: a south Indian pilot study. Pap., EPPO Conference on Storage Pests and Diseases, Paris, 11-14 June 1974. EPPO BULL., 4 (4), 447-453, (Eng. summ.), 17 re.s. (Authors' address: Institute of Development Studies, Brighton, England).

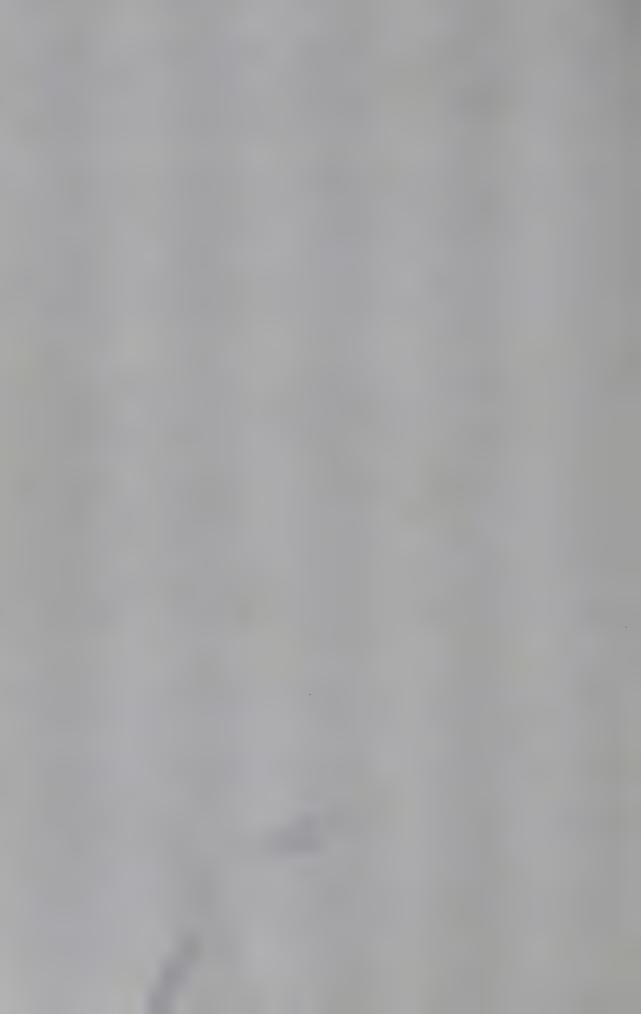
Storage research, especially at small-farm level, makes too little impact on policy, largely for want of evidence that the benefits of grain savings - especially to the poor and hungry - justify the costs of improved structures. A description is given of a pilot survey of the costs and benefits of alternative means of paddy storage in two South Indian villages. Preliminary results suggest that subsequent, ongoing work in a larger sample of villages, will justify substantial outlays on improved stores for small farmers and landless labourers.

SINGH, B., BHUSHAN, D. and ADLAKHA, R.C. 1974. Indian pesticides industry. A review. <u>Pesticides Annual</u>, 1974, 9-28, tabls, 5 annex, append, 24 refs. (Authors' address: Council of Scientific and Industrial Research, Rafi Marg, New Delhi, 11001, India).

Discusses the economic aspects of pests and their control, and surveys world trends in the pesticide industry. Traces history of pesticide use in India and lists pesticides currently in use. Annexure 2 lists firms manufacturing pesticide products, their addresses, technical materials and formulations. There are notes on imports and exports, and on research and development technologies Other subjects discussed include ecological considerations in the use of pesticides, the use of biological control methods, and the development of insect resistance.

STIRLING, H.G. 1975. Keeping warehouse temperatures down. Coffee in 2 (3), 38-40, 4 fig, illus. (Author's present address: Gunsons Sortex Ltd., Fairfield Road, London E3 2QQ, England).

Briefly quotes the results of coffee storage trials carried out in Kenya during a three and a half year assignment. These established that there was a rapid quality loss in coffee stores at above 10% m.c., or in conditions of high relative humidity. Scale model bag warehouses were built to see if it was possible to improve on the current conventional design. Findings were: that a double skin reflective roof with a freely ventilated air space between the layers reduced the internal store temperature; solar heating is further reduced by generous roof overhangs which shade the walls and by painting all external surfaces in sunlight in glossy white; controlling the ventilation by means of automatically regulated



electric fans provided some cooling and evened out humidity fluctuations. Bulk storage trials of coffee in an experimental silo led to the development of the Autocool system, which automatically selects suitable natural air at appropriate times of day or night and blows it through the bulk. Preliminary results are promising.

THOMAS, P.M. 1974. Public warehousing. Role of pesticides. Pesticides Annual, 1974, 81-84. tabls. (Author's address: J D Project, Manager-cum-Warehousing Advisory, FAO/UNDP, Dacca, Bangladesh).

Remarks that pesticides are important for the preservation of over 200 agricultural and industrial commodities stored in 820 central and state warehouses with a total storage capacity of 3.6 million tonnes. An estimate of 5 to 10% is given for losses caused by insects, rodents and other pests. The development of the Bang ladesh Warehousing Corporation, whose objectives include prevention of storage losses, quality control, stabilisation of prices, provision of credit facilities and integration of storage facilities is discussed. Common pests of stored products are listed, and details of application methods, dosages, and exposure periods are given for selected fumigants, dusts, sprays, smoke and rodenticides. Other notes relate to management and the economics of warehousing and pesticide usage.

THOSHANS, H. 1975. Installations de sechage et de stockage de cereales au niveau de la ferme et du village utilises au Dahomey. (Installations for drying and storage of cereals at farm and village level in Dahomey). Bloc Notes du Monde Rural FEMEC, 1975, (5), 15-18, 3 figs. (Fr.). (Publ. Development Commission of FEMEC, P O Box 790, Yaounde, Cameroon).

Begins by discussing sun-drying. Leaving grain to dry in the field is the simplest method but exposes it to attack by insect pests. It is recommended that grain be sun-dried on a raised platform, to provide through ventilation and avoid contamination. Artificial drying has several advantages, and an account is given of a simple wood fired dryer, the 'Brooks' drier. It is easy to construct, made of readily available materials, and can reduce the moisture content of 800-100 kg. of produce from 25% to 12% in two to three days. Specifications for building the dryer, and annotated plans are presented, together with notes on its operation. A list of required materials, and an estimate of costs are given. Shelled and unshelled maize can be dried equally quickly but if maize is to be used for seed it is suggested that an alternative method be used.



UNITED STATES: DEPARTMENT OF AGRICULTURE: AGRICULTURAL EXTENSION SERVICE/LOUISIANA STATE UNIVERSITY. 1975. Grain dryers, last but no least. Wld Fmg. 17 (7), 20, 22-23, 29, 2 tabl, 2 fig.

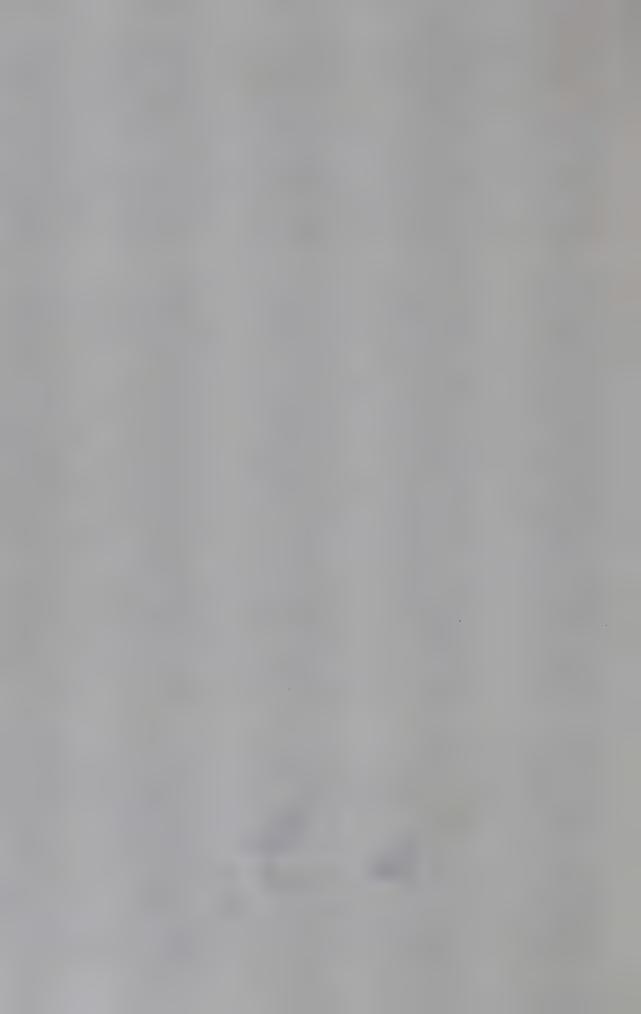
Discusses the need for grain drying and the advantages of methods of artificial drying. Lists safe storage moisture contents for maize, sorghum, oats, paddy, soyabeans, wheat. Notes are given on the design and choice of storage structures, and suitable layouts. There are some notes on the process of grain drying, and a chart indicates estimate of weight losses when drying grain or seed from one moisture content to another.

WALKER, D.J. 1975. Report of the Swaziland rural grain storage project. September 1972 - April 1975. v + 79 pp, 2 maps, 1 pl, 5 refs, 2 append. Publ. Grain Storage Section, Ministry of Agriculture, Malkerns Research Station, Swaziland.

Describes in detail a project, financed by the Freedom from Hunger Campaign (UK) and Christian Aid, which sought to improve the storag of maize and other durable commodities in the Swazi Nation areas. Outlines the present storage systems and their associated problems in the predominantly subsistence orientated community. A survey conducted in 1973, 1974 and 1975 lists the varieties of maize in store, the insecticides used and the storage containers encountered Full details of moisture contents and the extent of damage caused by insects, moulds and rodents are presented. An improved maize cob drying crib was promoted together with suitably available dilute insecticidal admixture dusts, e.g. 0.6% lindane for cob maize and 1.5% malathion for shelled commodities. The project attempted to improve the efficiency of fumigation practices in the small sealable metal tanks common throughout the country; efforts were made to increase the use of phosphine preparations for this purpose. A large scale training and extension programme was implemented throughout the life of the project.

WELTY, R.E. and WEEKS, W.W. 1975. Influence of relative humidity, temperature and time of fungal growth and chemical composition of flue-cured tobacco. <u>Tob. Sci.</u>, 11 July 1975, 77-80, 3 tabl, refs. (Authors' address: Southern Region, USDA Agricultural Research Service, and the Department of Plant Pathology and Crop Science, North Carolina State University, Raleigh, North Carolina 27607, USA

In three laboratory experiments, flue-cured tobaccos stored for up to 6 weeks at 75 to 90% relative humidity, and at 20, 25 and 30°C, were evaluated for mould growth, chemical composition and moisture content. Species of <u>Aspergillus</u> increased in the tobacco with increasing time, temperature and R.H. <u>A. repens</u> and <u>A. ruber</u> were



A. tamarii also occurred. In all studies, as the fungi increased, the tobacco sugar content decreased to below 3%. Some samples lost up to 31.2% dry matter.

WHITE, G.D., BERNDT, W.L. and WILSON, J.L. 1975. Evaluating diatomaceous earth, silica-aerogel dusts and malathion to protect stored wheat from insects. Mktg Res. Rep., US Dept. Agric., No 1038, iii + 18 pp, 9 tabl, 6 fig, 11 refs. (Authors' address: US Grain Marketing Research Centre, Agric. Res. Serv., Manhattan, Kansas, USA)

Reports results obtained in 3 years trials on 90,000 bushels of wheat treated with inert dusts and with malathion, and stored under field conditions in Kansas. Wheat was stored in 3,250 bushel circular metal bins. Two diatomaceous earth preparations, Perma-Guard and Kenite 2-1, and two silica-aerogel materials, Cab-O-Sil and SG68, were compared with the standard treatment with malathion and applied as the bins were loaded. The wheat was sampled periodically to detect insecticidal effectiveness, physical changes of wheat affecting grade, and chemical residues. Results of these tests are given. Chemical analysis indicated that malathion persisted in the wheat throughout the 3 year period. Airborne dust was a nuisance both when loading and unloading the bins, and increased problems with the machinery. Malathion and Perma-Guard proved most successful in controlling insect infestation.

WILLIAMS, B.D. 1975. A foot-powered thresher for rice, sorghum, oats and other small grains. Appropriate Technol., 2 (2), 607, illus. (Author's address: Melanesian Council of Churches, P 0 Box 80, Lae, Papua New Guinea).

Describes a simple machine which can be manufactured locally from wood, bicycle parts and scrap metal. It consists mainly of a wooden cylinder, with wire loops projecting asymetrically, rotated by means of a pedal. The unthreshed grain is held against the screened drum and grain and chaff are collected on a sheet laid below the drum. Winnowing still has to be done as a separate operation, but it is claimed the machine multiplies a man's productivity by at least three times.

YADAV, T.D. and PANT, N.C. 1975. Immunity of processed pulses to bruchids. Entomol. Newsl., 5 (1), 2. (Authors' address; Division of Entomology, Indian Agricultural Research Institute, New Delhi - 110012, India).

Reports observations on the egg laying and hatching behaviour of Callosobruchus maculatus and C. chinensis on husked and unhusked



pulses. Concludes that retention of the husk prevents loss of moisture, maintaining suitable environment for development. Removal of the husk disturbs the moisture regulation system, allowing loss of moisture and resulting in unfavourable conditions for development. The insect will develop but only to a limited degree on processed pulses stored in high humidity conditions.

The editor regrets that he is unable to supply reprints or photocopies of items abstracted. For this reason the names and addresses of authors are given whenever possible, to enable readers requiring further information to apply direct.

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Tropical storage abstracts

A selection of recent abstracts relevant to the storage of durable agricultural produce in the trapics

Issued by the Tropical Stored Products Centre (Tropical Products Institute), London Road, Slough, SL3 7HL, Buckinghamshire, England. - 6 APR 1976

J. R. O. Humphries, M.A.





- 6 APH 1976

AITKEN, A.D. 1975. Insect travellers. Volume I. Colcoptera.
Minist. Agric. Fish Fd., agric. Dev. advis. Serv., Pest Infest.
Control Lab. Tech. Bull. 31. xvi + 191 pp, 45 tabl, 12 pl, refs, index. ISBN 0 11 240891 5 (Publ. London: HMSO Price £4.25).

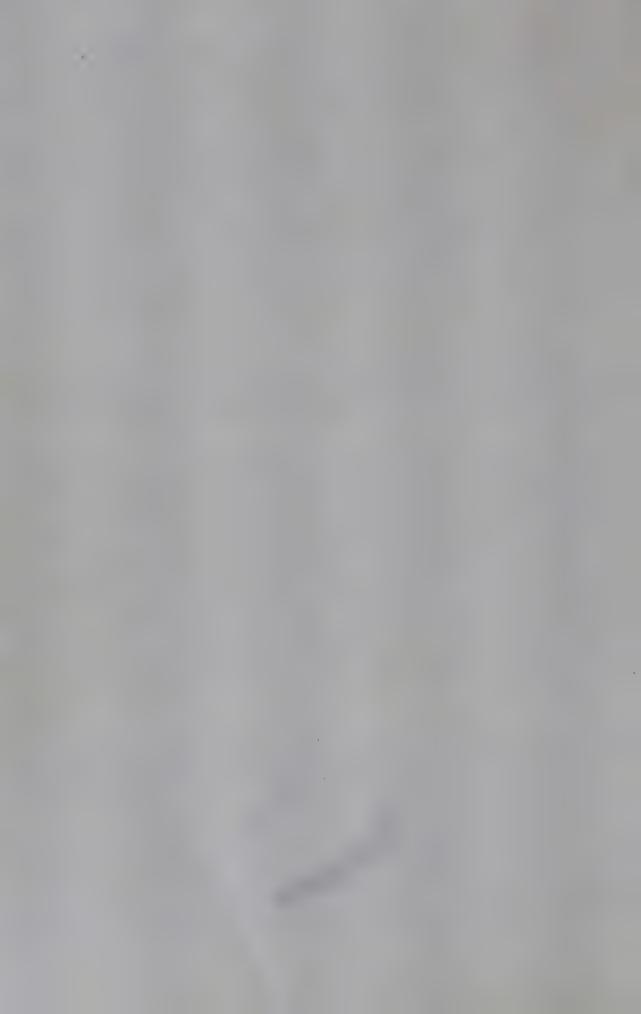
Presents an analysis of records of beetles noted by the Ministry's inspectors on cargoes imported into the United Kingdom, during the period 1942-1969. An introduction discusses: the kind of insects on food cargoes; the distribution of insects through trade; Ministry records; Zoo-geographic regions, nomenclature. Insect families are arranged in alphabetical order, and individual species are recorded under their scientific names. Common names are not used. For each individual species, brief notes are given, when available, on distribution, Ministry records of occurrence and biology.

BELL, A. 1975. Grain storage, with no pests and no pesticides. Ind. Res. News, 1975 (110). (Author's address: Industrial and Physical Sciences Division, CSIRO, P O Box 225, Dickson, ACT 2602, Australia).

Discusses increasing resistance of insect pests of stored grain to insecticides such as malathion, and studies to discover alternative control measures. Notes certain disadvantages of fumigation, and the probability of development of resistance to fumigants. Refrigeration is one possible alternative, and a brief report is given of trials with a concrete silo, insulated by a sprayed—on coating of 5 cm white polyurethane foam, and cooled by a downward draught of refrigerated air. The chief problem is one of cost. Another method is storage in inert atmospheres, with less than 2% oxygen, and purged with nitrogen. Good results were obtained. Other methods of generating nitrogen, or consuming oxygen, are under consideration. In the case of concrete silos, the main problem is obtaining a gastight seal.

CALDERON, M. 1975. The feasibility of environmental control for the protection of stored grain. <u>EPPO Bull.</u>, 5 (2), 125-136, refs. (Eng., Fr., Summ.) (Anthor's address: Institute for Technology and Storage of Agricultural Products, Jaffa, Israel).

Relevant data on the possibility of changing the stored grain environment, for the better preservation of grain in storage, are reviewed. The grain bulk is regarded as an ecosystem, in which the impact of damaging organisms can be controlled by ambient conditions. The influence of humidity, temperature, composition of atmospheric gases, atmospheric pressure and light is discussed. Lowering of humidity



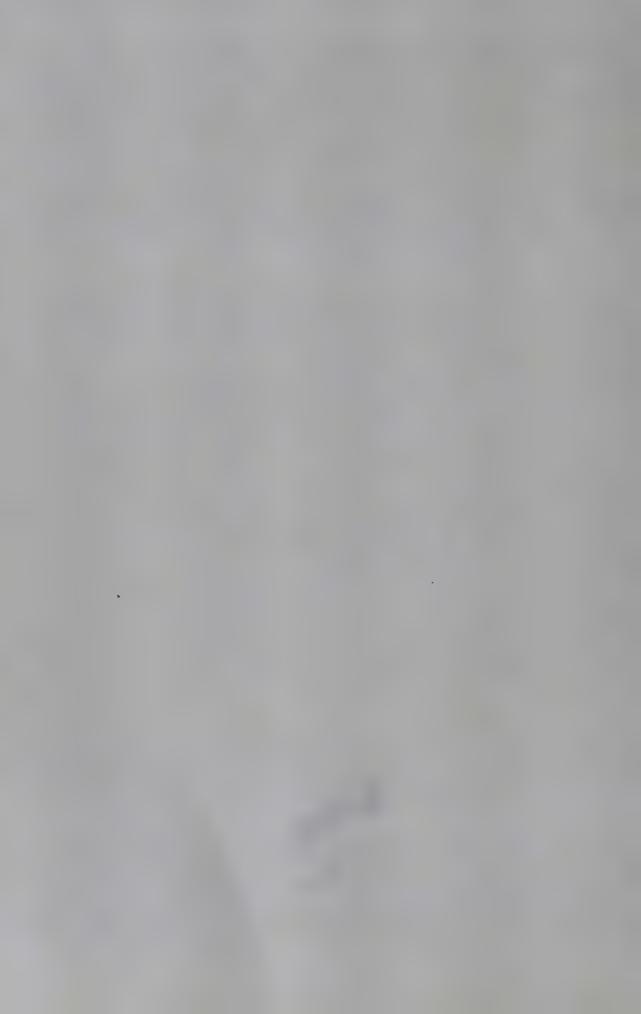
and of grain temperatures are well known and effective and practical ways for the prevention of damage in store. The modification of atmospheric gas compositions has been subjected to very extensive research, on which new methods for insect control could be based. Lowering the absolute pressure in storage containers has detrimental effects on storage insects. The practical implementation of this technique is discussed. Research on the effects of changing light conditions on stored grain insects is at its earliest stage but shows promise. Studies on integrated approach using several environmental elements for the containment of grain insects and microflora are proposed.

COGBURN, R.R. 1975. Stored rice insects research. 1975. Rice J., 78 (7), 78. (Author's address: Research Entomologist, Agricultural Research Service, USDA, Beaumont, Texas 77706, USA).

Reports on tests to find an alternative for malathion, to which many stored products insects are developing resistance. Rice in small bins, subjected to very heavy infestation pressure from a multi-species insect population, treated with pirimiphos-methyl at dosages of 10 and 15 ppm, was protected for 9 months, even from some malathion resistant insects. Trials were also carried out to estimate the amount of damage inflicted by stored products insects on rice. Preliminary results indicate that rough rice is much less subject to damage than is brown rice. Damage to brown rice varies according to insect species and rice variety. The maximum loss observed to date equals 29% of the value of the rice. A starting population equal to one gravid female Sitotroga cerealella in 500 g will totally destroy brown rice within three generations. Approximately 1000 varieties of rice were screened for susceptibility to attack by S. cerealella. About 10% appeared to be resistant. Hull morphology is one factor affecting susceptibility and varieties differ markedly in their nutritional suitability for some insects.

COGBURN, R.R. and SIMONAITIS, R.A. 1975. Dichlorvos for control of stored product insects in port warehouses: low volume aerosols and commodity residues. J. econ. Ent., 68 (3), 361-365, 2 tabl, 2 fig, 5 ref. (Author's address: R R Coghurn, Research Entomologist, U.S. Dept. Agric., Agric. Res. Serv., Beaumont TX 77706, USA).

A formulation of 90% dichlorvos and 10% heavy aromatic naphtha (HAN) was applied at a rate of 42.8 µg/l in Gulf Coast port warehouses for control of stored products insects, principally cigarette beetle, Lasioderma serricorne, Tribolium castaneum and Cadra (Ephestia) cautella. Efficacy was assessed by observing mortality among caged insects exposed at various locations in the warehouses and by



monitoring natural infestations. A prototype rotary-whip aerosol dispenser gave excellent control of caged insects and of heavy natural population. Success was attributed to thorough distribution of the insecticide by the large volume of air circulation produced by the machine. A conventional thermal aerosol machine gave excellent control when auxiliary fans were used. Flour, maizemeal, milled rice and CSM (corn-soya-milk) were exposed to all treatments. Some packaging materials permitted build-up of residues exceeding 0.5 ppm, but all residues dissipated to less than 0.5 ppm after 7 days and were undetectable after 30 days.

DELOUCHE, J.C. 1975. Seed processing and storage. Proc. int. Symp. 'The role of seed science and technology in agricultural development organized by the Food and Agriculture Organization of the United Nations in cooperation with the Federal Government of Austria, Vienna, 1-6 October 1973, 1975. Austrian Funds-in-Trust, TF/INT 75 (AUS), FAO/AUS/TF 145. Rome: UN:FAO, 108-124, 4 fig. (Author's address: Dr J C Delouche, Seed Technology Laboratory, Mississippi State University, P O Box 5267, Mississippi State, Miss. 39762, USA)

Discusses the growing importance of seed drying, processing and storage technology in development of a seed programme/industry and problems encountered, particularly as the quantities handled These problems are aggravated in tropical and subtropical countries. Seed drying is discussed in detail, and points stressed are seed maturity, mechanised harvesting and the use of various artificial drying systems, especially those utilising unheated air. Good programming is essential to avoid bottlenecks whilst making optimum use of available capacity. After drying, several processing operations may be necessary to prepare the seed for terminal storage, distribution and marketing; shelling, threshing and preconditioning as necessary, and cleaning, sizing, treating and packaging. The principal objective of successful seed storage is to maintain viability, and the several factors affecting this are discussed. Various types of seed storage, and levels of duration of storage are described, and three examples of successfully implemented facilities, in Peru, Honduras and the Philippines are given. Guidelines for progress are laid down, and examples of layout and flow-sheet are given.

DEORAS, P.J. 1975. Rat menace and how to fight it. <u>Pestigides</u>, India, 2 (8), 38-43. append, 16 ref. (Author's address: Dr P J Deoras, Scientist, Sahitya Sahawas, Bandra East, Bombay-51, India.)

Discusses the relationship between rodents and the human economy and welfare, with special reference to: actual material damage;



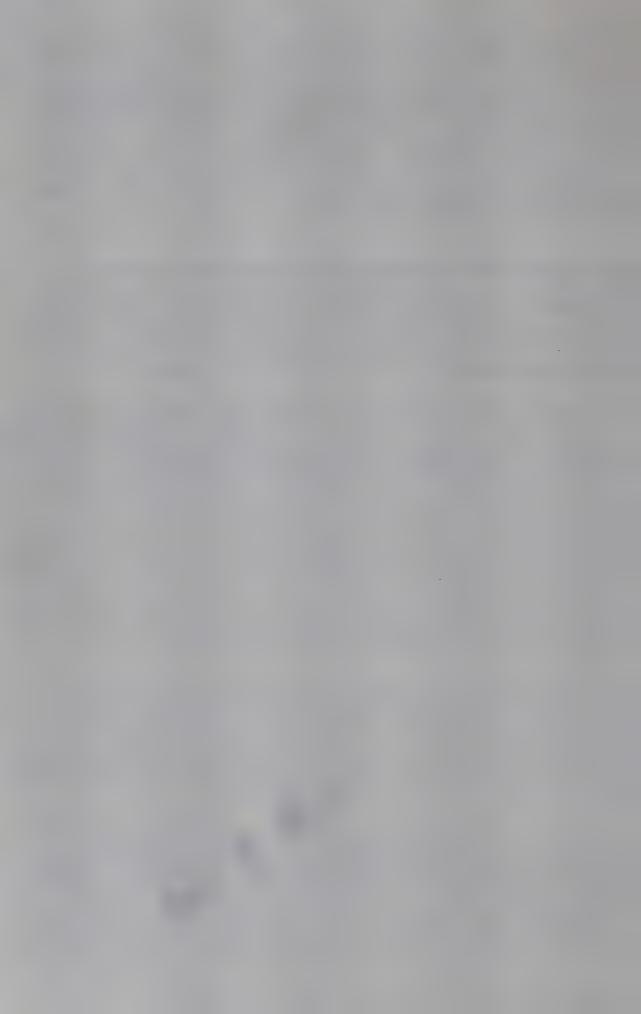
diseases; costs of control measures. Some estimates of losses are given and the need for studies of rodent ecology is emphasised. A general description of rodents and genera occurring in India, is given, and Rattus rattus, Mus musculus, Bandicota bengalensis, Rattus norvegicus and Bandicota indica are examined more fully. Some notes are given on rodent biology and behaviour. Rodent control methods discussed include trapping, baiting, fumigation and miscellaneous methods such as keeping of predators, use of attractants, repellants and deodorants, chemosterilants, ultrasonic equipment and bacteria.

FAO: WORKING PARTY OF EXPERTS ON THE RESISTANCE OF PESTS TO PESTICIDES. 1975. Recommended methods for the detection and measurement of resistance of agricultural pests to insecticides. Tentative method for adults of some major pest species of stored cereals, with methyl bromide and phosphine. FAO Method No 16, FAO Pl. Prot. Bull., 23 (1), 12-25, 6 fig, 5 append.

A test method is described for detecting and measuring resistance to the fumigants methyl bromide and phosphine in <u>Sitophilus oryzae</u>, <u>S. zeamais</u>, <u>S. granarius</u>, <u>Rhyzopertha dominica</u>, <u>Tribolium castaneum</u>, <u>T. confusum</u>, <u>Oryzaephilus surinamensis</u> and <u>O. mercator</u>. The method is based on exposure of adult insects to discrete atmospheres containing fumigant. Exposure periods are 5h for methyl bromide and 20h for phosphine. Responses are determined 14 days following termination of the exposure. Base-line data are established with reference strains of known susceptibility from which it is possible to select discriminating doses that may be used to monitor samples of beetles for resistance. Survival in such tests is indicative of resistance, following which extensive testing should be carried out to determine the degree of resistance present.

FAO: WORKING PARTY OF EXPERTS ON THE RESISTANCE OF PESTS TO PESTICIDES. 1974. Recommended methods for the detection and measurement of resistance of agricultural pests to pesticides. Tentative method for adults of some major beetle pests of stored cereals with malathion or lindane. FAO Method No 15. FAO Pl. Prot. Bull., 22 (5/6), 127-137, 31 fig, 4 append.

Test methods are described for detecting resistance to malathion or lindane in Sitophilus oryzae, S. zeamais, S. granarius, Rhyzopertha dominica, Tribolium castaneum, T. confusum, Oryzae-philus surinamensis and O. mercator. The methods are similar in principle and basid detail to the FAO method prescribed for T. castaneum, and depend on exposure of adult insects to insecticide impregnated papers. Responses are judged after 5 to 6 or 24 hours,



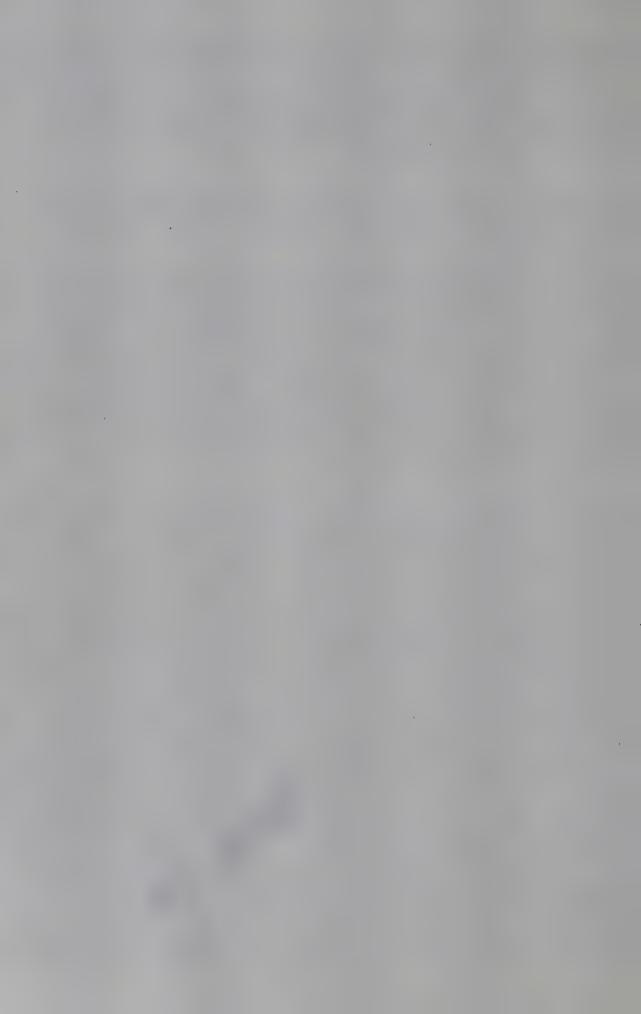
according to the speed of action of the insecticides. Base line data are established with known susceptible strains. It is then possible to select discriminating concentrations which can be used to screen samples of beetles for resistance. Survival in such tests is a danger signal calling for more extensive testing to define the degree of resistance present.

FRIENDSHIP, R. 1975. The sack sieve. Ethiopian Grain Rev., 2 (2), 17-19, 5 figs, 2 ref. (Author's address: P 0 Box 3721, Addis Ababa, Ethiopia).

Describes the construction of a sack sieve, modified from the design prepared by the Tropical Products Institute to meet Ethiopian requirements, and capable of sieving the contents of one whole sack at a time. The sieving mechanism is hand-driven and re-bagging takes place semi-automatically. Insects, broken grains, etc. are separated from the commodity using various interchangeable screens. It has been used to test wheat, maize, coffee, horsebeans, haricots and lentils. Main problems are bridging of produce in the feed mechanism and transportation. The sieve is now in use as standard equipment at the export point of Assab.

HAYS, N.M. 1975. The marketing and storage of food grains in northern Nigeria. Samaru misc. Pap. 50, x + 155 pp, 36 tabl, 17 fig, 40 refs, 11 append. (Publ. Institute for Agricultural Research, Samaru, Ahmadu Bello University, P.M.B. 1044, Zaria, Nigeria. Price 2 naira (\$3.04)

Reports on a detailed survey carried out during the 1970 and 1971 crop years. Studies were restricted to the two most important grain crops, guinea corn (Sorghum vulgare) and millet (Pennisetum typhoider (syn. typhoides) and included: the traditional marketing system; production, storage and marketing patterns at the producer level: detailed evaluation of marketing costs in terms of the services provided; budgeting of incomes of marketing intermediaries; examination of intermarket price differentials in relation to transport and other costs; examination of storage costs as a factor in determining price changes. Three villages and three major markets were examined in detail, and data were collected from farmers and traders. Some descriptions are given of production and marketing. Estimates indicate that approximately 20% of millet and sorghum are dissipated as ritual gifts, tithes, etc., the balance being stored. Village storage methods observed were in-hut storage of threshed grain in sacks, and storage of bundles of unthreshed grain in a "rumbu" or dried earth granary, constructed of dry grass and clay, resting on large stones and covered with a thatched roof. Some estimated storage costs are given for a typical rumbu of 1.1 metric ton capacity. An examination is made of transport systems and urban



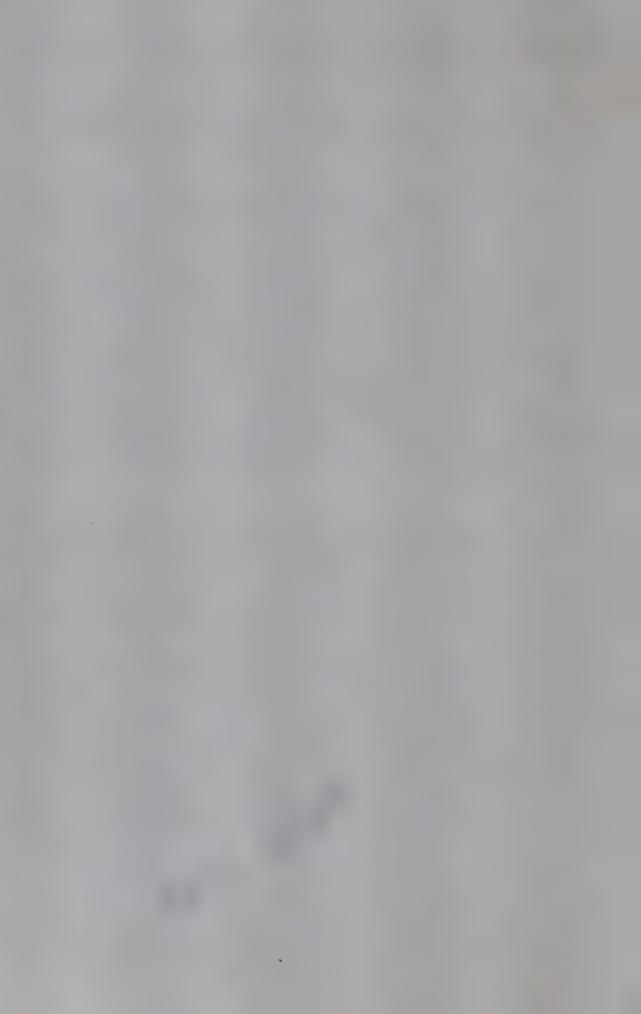
markets, and recommendations are made for the modernisation and expansion of marketing services.

INDIA: INDIAN AGRICULTURAL RESEARCH INSTITUTE: AGRICULTURAL ENGINEERING DIVISION 1975. Solar dryer for small farmers. Pesticides, India, 9 (4), 59.

Reports on a solar energy collector-cum-dryer for drying crops quickly after harvest, designed and developed by the Division in New Delhi. The main components of the system comprise a metallic roof, air duct, blower and grain bin. The roof is fabricated from corrugated sheets blackened with bituminous paint. The air duct is made from plywood board fitted 6 cm below the roof. One end of the duct is open as air inlet, the other is connected to the blower. Heat absorbed by the roof is transferred to air in the duct, and then forced through the wet grain bed in the bin by means of the blower. Some test results are given. Grain with up to 34.9% m.c. could be dried to 15% m.c. in adverse humidity and fluctuating sunshine conditions. Some notes are given on roof orientation and elevation, and the use of transparent covers (glass or polythene sheet) to increase air temperature rise.

LA HUE, D.W. 1975. Evaluating Gardona and malathion to protect wheat in small bins against stored grain insects. Rep., US Dep., Agric., agric. Res. Serv., Mktg. Res. Rep. No 1037, iii + 12 pp, 20 tabl. (Author's address: Entomologist, North Central Region, US Grain Marketing Research Centre, Agricultural Research Service, US Dept. Agriculture, Manhattan, Kansas, USA).

Low volume (LV) spray and drip-on applications of malathion, an ultra-low-volume (ULV) application of Gardona, and a formulation of malathion in granular carbon were compared as protective treatments against insect attack to wheat stored in small bins for 12 months. All malathion treatments were applied at the standard dosage rates of 10.42 ppm technical malathion. Damaging infestations of mixed populations of stored grain insects developed in all bins of untreated wheat during the first 4 months of storage from insects released in the storage room. The LV malathion spray and malathion granular carbon treatment gave excellent protection for 12 months. Malathion residues recovered from the LV spray application were fairly consistent for each ageing period, and declined from 4.5 to 1.5 ppm during the 12 months. Malathion residues from the granular application were higher, but showed greater variation between replicates. Residue patterns in wheat treated with LV drip-on emulsion were unsatisfactory, and samples from three of the five treated bins showed deposits much below the prescribed



amount, and one bin had an excess of residue. Insect control varied accordingly. Gardona residues, which averaged 6.16 ppm 24 hours after treatment, fell rapidly during the first 2 months after treatment to an average of 1.78 ppm. Sufficient residues remained to protect the wheat against insect attack for a total of 8 months.

LOCKWOOD, L.M. 1975. Bamboo-reinforced cement. Rep. IVS/CORR Grain Storage Project, Jalchatra, Tangail District, Bangladesh. duplic, i + 7 pp, tabl, fig, refs. (Author's address: Appropriate Technology Cell (Storage and Handling), Bangladesh Agricultural Research Council, 130-C, Road 1, Dhanmandi, Dacca, Bangladesh).

Reports on tests to compare ferrocement blocks with bamboo reinforced cement blocks and unreinforced cement. Bamboo reinforcement was woven into mats, using strips approx. $\frac{1}{8}$ in. wide and 1/32 in. thick at $\frac{1}{2}$ in intervals. Cement had a sand-to-cement ratio of 2:1, and blocks were kept outside to cure for a period of 12 months. In tests, the blocks, measuring $\frac{3}{4} \times 8 \times 24$ in. were supported at each end and weight applied to the middle. The ferrocement slabs were by far the strongest, the bamboo-reinforced were much the weakest. After one year there appeared to be very little bonding between the bamboo and the cement. The bamboo did appear to confer some resistance to shock damage.

NWANZE, K.F. and HORBER, E. 1975. How seed size affects the occurrence of 'active' and 'miniature' forms of <u>Callosobruchus maculatus</u> in laboratory populations. <u>Environ. Ent.</u>, 4 (5), 729-732, 2 tabl, 3 fig, 8 refs. (Authors' address: Department of Entomology, Kansas State University, Manhattan 66506, USA).

The proportion of the 'active' form of the cowpea weevil, <u>Callosobruchus maculatus</u> F., among a population emerging from infested cowpeas in the laboratory is greatly reduced in small seeds. It is replaced by a 'miniature' form of the insect. The factors conditioning production of the 'active' form appear to operate when sufficient food is available. Small-seeded varieties would have a limiting effect on population increase of <u>C. maculatus</u> but breeders have to select cowpeas for a size acceptable to consumers and, in addition, for intrinsic characteristics which confer resistance to the insect, such as a deterrent seed coat or reduced nutritional value to the insect. Frequency of miniature forms appears to offer a better indicator than that of the active form in screening varieties for resistance.



OLVER, E.F. 1975. Quality grain conditioning. Proc. Grain Conditioning Conf., Univ. Ill., Champaign, 1974, 2-8, 1 fig. (Author's address: Professor of Agricultural Engineering, University of Illinois, Urbana, Illinois 61801, USA).

Points out the importance of maintaining quality in stored grains, with special reference to soya beans. The principal factors are: harvesting techniques; development of suitable varieties; use of solar energy for drying the crop; enhancing the quality by the use of appropriate grain conditioning systems. The use of good management aids associated with drying in farm conditioning of grain is examined, and aids mentioned include dryeration, aeration, storing of grains, high-low temperature systems, cooling, preservatives, high-moisture storage, plastic covers and the use of moisture content/mould activity curves to estimate safe storage periods. A psychrometric chart is included with the text.

PARMAR, B.S., ATTRI, S., SINGH, R.P. and MUKHERJEE, S.K. 1975. Karanja oil as a synergist for chlorinated insecticides. Pesticides. India, 9 (5), 29-30, 1 tabl, 6 refs. (Authors' address: Division of Agricultural Chemicals, Indian Agricultural Research Institute, New Delhi 100-012, India).

'Karanja' (Pongamia glagra Vent) is a non-edible oilseed readily available in India. Early reports indicated that it acted as a synergist for endrin against the housefly Musca domestica L. The present report covers tests with two ratios of insecticide to oil (1:1 and 1:5), using benzene as solvent and an emulsifier. Test insecticides were: BHC, lindane, toxaphene, aldrin, dieldrin, endrin, heptachlor and thiodan, and the aromatic hydrocarbons DDT and methoxychlor, all employed against adult Tribolium castaneum. Considerable synergistic effect was noted in the case of lindane, endrin, heptachlor and thiodan, but a reduction in toxicity occurred with BHC and toxaphene. No explanation of the results is attempted.

PETERSEN, W.H. 1975. New developments - solar heat for crop drying. Proc. Grain Conditioning Conf., Univ. Ill., Champaign 1975, 47-48, illus. (Author's address: William H Petersen, Extension Agricultural Engineer, South Dakota State University, Brookings, South Dakota, 57006, USA).

Refers to successful trials with a solar/electric crop drying installation in South Dakota in recent years. Points out the advantage of solar heating for crop drying. Firstly, a temperature rise rather than a fixed temperature is adequate for crop drying,



making it possible to use a simple inexpensive heat collector. Secondly no heat storage is needed - shelled maize itself acts as a heat storage, although a secondary heat source such as electricity may increase the drying speed. Thirdly, the probabilities of collecting solar energy, even in cloudy conditions, are excellent A description is given of a simple installation, consisting of a bin, with a double skin painted black on the outside as heat collected and with a simple heater, fan and ducting system as supplementary.

RICHARDSON, H. and SMEE, L. 1975. Freight container fumigation and wood penetration by ethylene oxide mixture against quarantinable termites and other insects. <u>Pest Control</u>, 43 (9), 20, 22-24, 2 fig, 9 ref. (Authors' address: H. Richardson, R.D. No 3, Box 115, Milford, N.J. 08848, USA: L. Smee, c/o J.R. Morschel, Director, Plant Quarantine Service, Australian Dept. of Health, P 0 Box 100, Woden, A.C.T. 2606, Australia).

Ethylene oxide-carbon dioxide mixture (10:90 by wt) showed high efficiency at a dosage of 20 lg/100 ft³ (320 g/m³) for 48 h. in wood and nest penetration tests against 3 species of flour beetles and a quarantine termite in 1180 ft³ (33.4m³) freight containers, loaded and empty, in the open at c. 60°F by day and 44°F by night (15.5 - 6.7°C). The gas showed good but rather slow distribution as compared to fan circulation in the containers as indicated by insect and chemical tests. The use of this mixture for quarantine purposes is discussed.

ROSS, I.J., HAMILTON, H.E. and WHITE, G.M. 1975. Principles of grain storage. Proc. Grain Conditioning Conf., Univ. Ill., Champaign 1975, 9-23, 9 fig, 6 ref. (Authors' address: Professor, Agricultural Engineering Department, University of Kentucky, Lexington, Kentucky 40506, USA).

Summarises main factors in maintaining condition of grain in store, and selects: the moisture content of the grain; the temperature; the oxygen supply; the pH; the condition or soundness of the grain. In discussing moisture content, its effect on microorganisms and relationships between equilibrium moisture content and equilibrium relative humidity are shown to be of primary importance. Temperature directly affects the growth of microorganisms as well as moisture content/relative humidity equilibria. The possibilities of controlling growth of microorganisms by maintaining low oxygen contents are examined. Microbial growth is also directly related to pH of contained moisture. Grain in poor condition i.e. containing a high proporation of cracked and damaged kernels, is more liable to microbial invasion than sound grain, and needs to be maintained at a lower moisture content. A relative humidity of



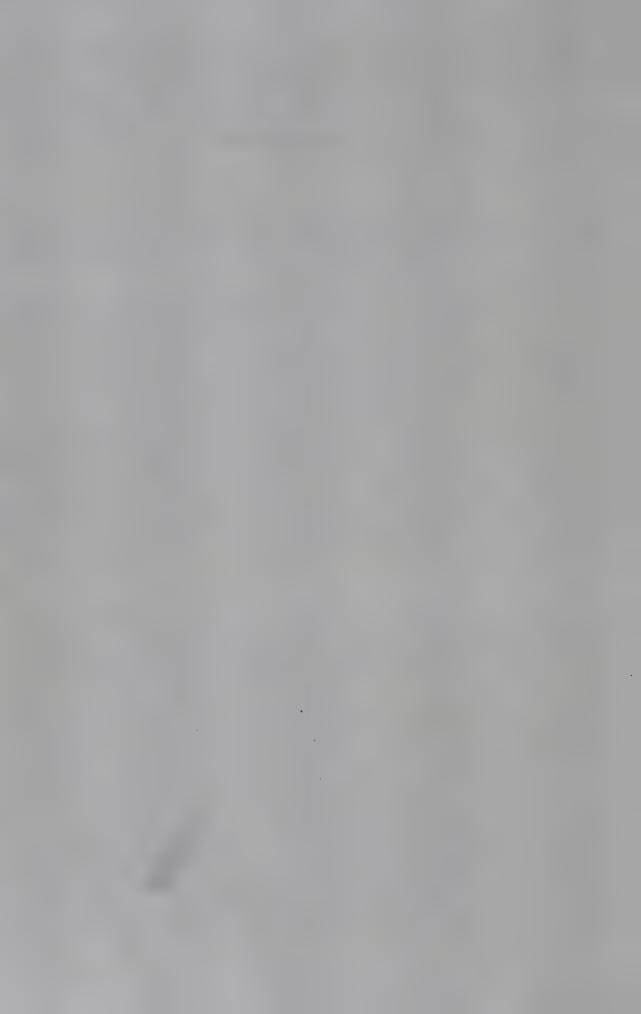
65% is selected as the maximum safe storage level, and some data are given for various temperatures. There are notes on the moisture contents of grain in bins and moisture migration. The possibility of lowering pH by the use of organic acids such as propionic acid is discussed. Control of insects and rodents is briefly stated to be achieved by lowering the temperature and use of rodent proof bins respectively.

SINGH, S.N. and LAL, S. 1975. Effect of seed storage period on viability of mung bean (<u>Phaseolus aureus Roxb</u>) seeds. <u>Seeds Res.</u>, 3 (1), 59-60, tabl, refs. (Authors' address: Uttar Pradesh Institute of Agricultural Sciences, Kanpur, U.P., India).

Gives a brief report on trials to determine the effect of storage period on the viability of mung bean seeds subjected to two methods of storage. Ten varieties were tested. In one treatment, pods were threshed and sun-dried seeds were stored in paper bags after dusting with 10% BHC. In the other pods were thoroughly dried and stored as such in paper bags. All samples were then stored in a tin box at ambient temperature for four years, 1966 to 1969. Germination tests were carried out on 50 seeds from each lot in July each year. Over the period, varietal differences were noticeable, and pods gave slightly better results than threshed seeds treated with insecticide. It is concluded that if the seeds are kept free from bruchid attack, either by insecticidal treatment or by storing in the pod, they can be stored for up to 4 years without loss of viability.

SINHA, R.N. 1975. Effect of dockage in the infestation of wheat by some stored-product insects. J. econ. Ent., 68 (5), 699-703, 3 tabl, 17 ref. (Author's address: Research Station, Agriculture Canada, 25 Defoe Road, Winnipeg, Manitoba, Canada R3T 2M9).

Reports on tests with 10g samples of Manitoba wheat at 27 + 0.5°, 30 + 0.5° and 33 + 0.5°C, in atmospheres at 70 + 2% R.H. Dockage comprised 12 components including wild buckwheat, broken wheat, small wheat kernels and various weed seeds, and samples tested were at levels of 0%, 2%, 5% and 7%. At the lowest temperature, the proportions of eggs developing to adults was high for Cryptolestes ferrugineus, moderate to low for C. turcicus, Oryzaephilis mercator, 0. surinamensis, Stegobium paniceum, Tribolium castaneum and T. confusum. Presence of dockage significantly increased the number of adults developing at the 7% dockage level in 0. surinamensis. Adult survival of Ahasverus advena was adversely affected by higher dockage levels at the



higher temperatures. High dockage levels (c. 10%) affected

T. castaneum and O. surinamensis, but at 33°C optimum temperature

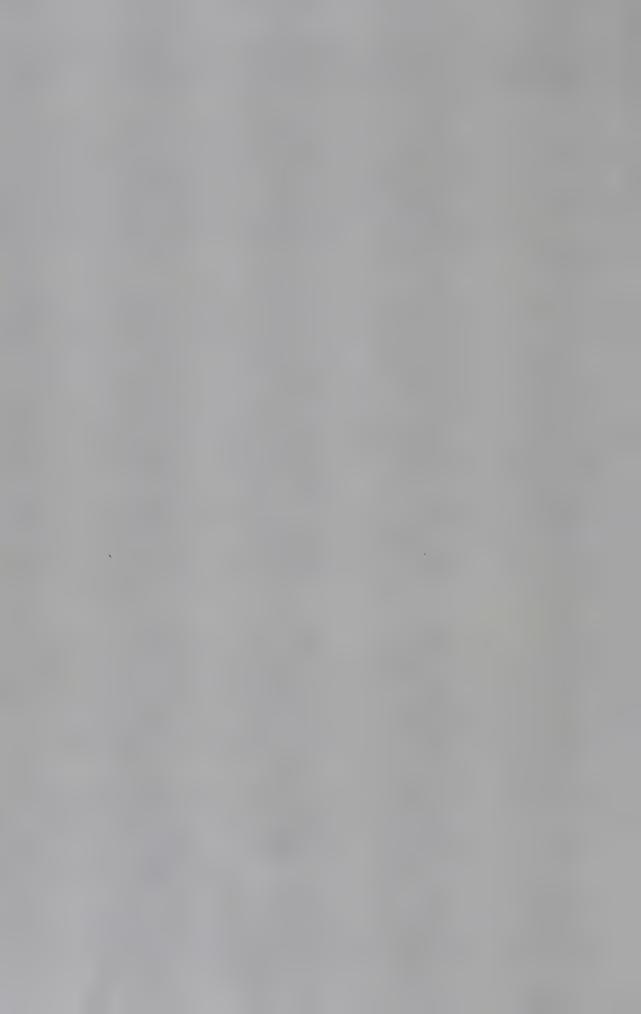
T. castaneum multiplied well on dockage-free wheat.

TORRE, R.G. de la 1970. Conservacion tecnica de granos alimenticios (Technical conservation of food grains), 1973 Ed. iv + 22 pp, l tabl, 16 fig, 20 ph. (Span.) (Publ. Mexico/Bueonos Aires, Centro Regional de Ayuda Tecnica, Agencia para el Desarrollo Internacional (AID) (Regional Centre for Technical Aid, Agency for International Development). (Distribution through AID missions in Latin-American countries).

Handbook originally prepared by Ministry of Agriculture, General Office for the Improvement of Land Use, Office for the Improvement of Agriculture, Peru, Manual No 12. Discusses the economic concept of storage, and the factors which determine the deterioration of stored grain. Brief notes are given on the effect of relative humidity, temperature and moisture content. Insect pests are briefly described in three groups: a. insects which attack grain in the field; b. insects which only attack grain in store; c. insects which cause damage in the field and in store. Reference is made to the effect of microorganisms and rodents. Other topics discussed include types of storage, in-store drying, methods of stacking, equipment, procedures for inspecting grain, sources of infestation and the economics of pest control. Control methods discussed include preventive admixture of insecticides, disinfestation using sprays on sacks or direct on the commodity, and fumigation.

U THET ZIN, COUDERT, J.P.B., ONN, L.S., MASUMOTO, T. and ANDERSON, J.W. 1975. Report to the government of the Republic of Vietnam on a Task Force for the rehabilitation and development of rice processing, storage and marketing in Vietnam Phase I. United Nations Development Programme; Food and Agricultural Organisation of the United Nations, Bangkok, January 1975. RVN/74/014. Typewritten 67 pp.

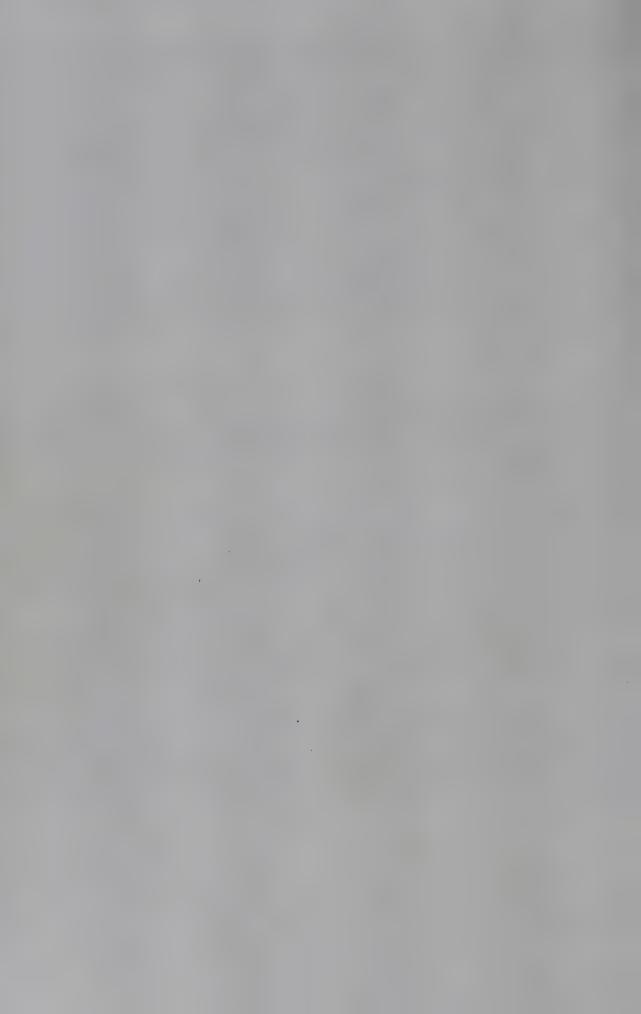
The terms of reference of the Task Force were: (i) assess the existing paddy procurement system, the technical and organisational aspects of the rice storage and milling industry and the rice marketing system, (ii) identify the basic problems of organisational and technical nature which affect procurement, storage, processing and marketing of rice, (iii) examine present paddy and rice quality standards and advise on the introduction of suitable paddy and rice grades and standards, (iv) identify possible improvement in procurement, storage processing and marketing methods and facilities, (v) visit processing facilities in the country to evaluate present



milling methods and equipment and recommend appropriate steps for improvement, (vi) advise the government on measures to be taken for the development of rice processing and storage and to formulate a follow-up programme under Phase II of the project on the basis of the final recommendations of the Task Force. A National Food Administration (NFA) programme was established in December 1973 to deal with rice storage, processing and marketing. The main problems confronting NFA are the lack of technicians and effective means for assessing the value and quality of grain in their procurement operations. The most pressing problem facing the farmers is the slow process of drying due to weather conditions and the danger of spoilage,, if the wet paddy is not dried within a few days. Unless the problems arising at this stage are tackled effectively, any attempt to solve the problems occurring at the subsequent stages of operations would be difficult and ineffective.

U THET ZIN, GARIBOLDI, F.M., HAWKEY, R. and ELLIS, D.M. 1974. Mission report to the government of Indonesia on a Task Force for rice grading, storage and processing in Indonesia. United Nations Development Programme: Food and Agricultural Organisation of the United Nations, Rome 1974. INS/72/057. Typewritten 59 pp + ix appendices.

A programme of work was undertaken by the Task Force, embracing the following areas: (i) examination of the present paddy and rice quality standards and to advise on the introduction of suitable paddy and rice grades and standards. (ii) identification of possible improvement in procurement, storage, processing and marketing methods and facilities, (iii) assistance in the installation and operation of laboratory and processing facilities at the Tambun Rice Processing Centre, (iv) visit to processing facilities in the areas around Jakarta, Jogjakarta and Surabaya for evaluation of the present milling methods and equipment used, (v) advise on the establishment of an advisory service on rice processing within BULOG, (vi) preparation of recommendations for action to be taken for further development of the rice processing industry and provision of technical assistance requirements for further development programmes. Recommendations are made regarding grading of paddy and rice, storage, milling and quality improvement.



VERMA, R.S. and GUPTA, P.C. 1975. Storage behaviour of soyabean varieties vastly differing in seed size. Seed Res., 3 (1), 39-44 5 tabl, refs. (Author's address: G B Pant University of Agriculture and Technology, Pantnagar, Nainital, India).

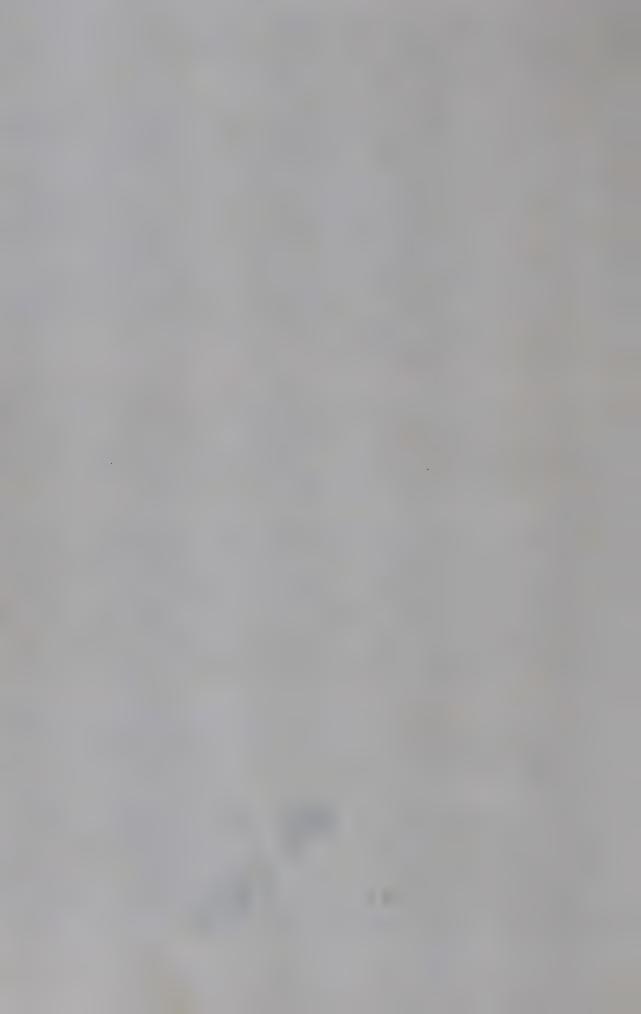
Seeds of nine varieties of soyabeans were taken from the 'Kharif' (winter) harvest of 1972, for studies on their viability, seedling vigour and biochemical changes during storage. Seed weights per 100 seeds varied from 9.3 to 21.2 g. It was observed that seeds with high initial viability (more than 90%) could be stored safely for 6-8 months. Small seeded varieties were found to deteriorate rore slowly than those with large seeds. Deterioration in seedling vigour started earlier than loss in viability. Measurement of free fatty acids, leaching of sugars and electrical conductivity in aqueous leachate were found to give a good estimate of soyabean deterioration during storage. Cold room storage gave better results than storage at ambient conditions for preservation of viability and seed vigour of soyabean seeds.

WAINMAN, H.E., CHAKRABARTI, B., ALLAN, E.N.W. and MILLS, K.W. 1975. Fumigation with phosphine of stacked flour in polythene-clad sacks. Int. Pest Control, 17 (5), 4-8, 1 tabl, 7 fig, 3 refs. (Authors' address: Ministry of Agriculture, Fisheries and Food, Pest Infestation Control Laboratory, London Road, Slough, Berks. SL3 7HL, England).

Laboratory tests in chambers indicated that satisfactory penetration of flour in polythene-clad sacks for stored product pest control could be achieved with phosphine during an extended exposure period. These trials, and permeability tests on polythene sheet, were followed by fumigation of stacks of 70 and 80 tonnes of bagged flour using a double layer of gas-proof sheets under varying temperature conditions. Satisfactory results were obtained. Suggested dosage rates for different exposure periods are given.

WIKRAMANAYAKE, V.E.A. and PERERA, H.E.M. 1975. Report on the survey of storage losses. Res. Bull. 2/75, 13 pp, 3 tabl, 2 fig, 2 append. (Publ. The Paddy Marketing Board, 5 Elibank Road, Colombo 5, Sri Lanka).

Recently the paddy Marketing Board has been called upon to keep paddy in storage for periods of many months, and has repeatedly found it necessary to write off losses caused by drying out and deterioration during storage. A survey was conducted with a view to estimating these losses and formulating a procedure to minimise loss of weight of paddy in stores, and to carry out a laboratory analysis of samples to help determine the major causes of these



losses and their effect on outturns and quality of milled rice. The report examines the results and recommends courses of action. Principal recommendations include more careful inspection at time of procurement, evaluation of suitability of storage premises, planned stacking, regular and careful inspection, regular checking of physical stocks, accurate keeping of tallies, planned movement of stock to ensure first in—first out, and provision for pest control including fumigation.

WIMBERLEY, J.E. 1975. Ford Foundation - International Rice Research Institute post production projects in India and Sri Lanka. Pap. pres. Plann. Meet. post Harvest Crop Prot., East-West Fd Inst. Honolulu, Hawaii, Sept. 1975. duplic., 18 pp. (Author's address: The Paddy Marketing Board, P O Box 205, Colombo, Sri Lanka).

Reports progress in two programmes of post harvest development, one in India and the other in Sri Lanka. In India, a one-year study of post production practices had indicated that methods and equipment used in paddy cleaning, drying, storage and processing were obsolete and resulted in substantial losses of food grains. It was suggested that with modern technology these systems could be improved, and a pilot programme was recommended. This was to include as far as possi locally produced handling machinery, etc. and in particular reinforc concrete silos manufactured by Indian firms. With completion of the construction phase, training of personnel to operate the equipment was organised, and this included training in management. Other features included the introduction of improved milling and parboiling techniques. Bulk storage had been less readily adopted, mainly because of capital cost, and possibilities of improving existing bag storage. Generally it is concluded that India has proved the value of modern technology in post-production handling of paddy. As regards Sri Lanka, the Paddy Marketing Board/International Rice Research Institute conducted a survey, and identified eight major post production areas in which problems occurred. These were: harvesting; threshing; drying; storage; parboiling; milling; procurement and marketing; systems coordination. It was estimated that losses of paddy due to these factors totalled 25-30% of total paddy production. The lack of trained personnel was emphasized, and recommendations were made to reduce losses, to improve rice quality and reduce costs of the P.M.B. operations. Implementation has involved training, improvement of existing storage, provision of additional storage and processing facilities. This has required collaboration by manufacturers, contractors, Government units and private millers in order to establish an integrated post-production system, and some details are given. The question of communications and exchange of technical expertise between Asian nations is discussed, and suggestions for future overall systems development are made.



YADAV, T.D. and MOOKERJEE, *P.B. 1975. Use of single, binary and tertiary gas mixtures of nitrogen, carbon dioxide and oxygen in seed storage. Seed Res., 3(1), 34-38, 3 tabl, ref. (Author's address: Division of Entomology, Indian Agricultural Research Institute, New Delhi - 110012, India). * deceased.

Wheat seeds of six varieties at 10.5% moisture content were stored in six different atmospheres comprising nitrogen and carbon dioxide alone, their 50:50 binary mixture, a binary mixture with low levels of oxygen or a tertiary mixture of the three gases. Storage was studied over a period of 13.5 months at 27 + 1.5 °C. Although results indicated no decline in germination of seed in any of the conditions, nitrogen was considered to give best results owing to its slow diffusivity and rapid lethal action against insect storage pests. It is concluded that the viability of the germ plasm of crop seeds could be maintained for long periods by storage under nitrogen.

The editor regrets that he is unable to supply reprints or photocopies of items abstracted. For this reason the names and addresses of authors are given whenever possible, to enable readers requiring further information to apply direct.

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No. 6

Tropical storage abstracts

A selection of recent abstracts relevant to the storage of durable appropriate relevant to the storage of durable relevant to

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Editor: J.R.O. Humphries, M.A.

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ANON. 1976. Containing costs with liners. Mech. Handling int., January, 1976, 25-27 illus.

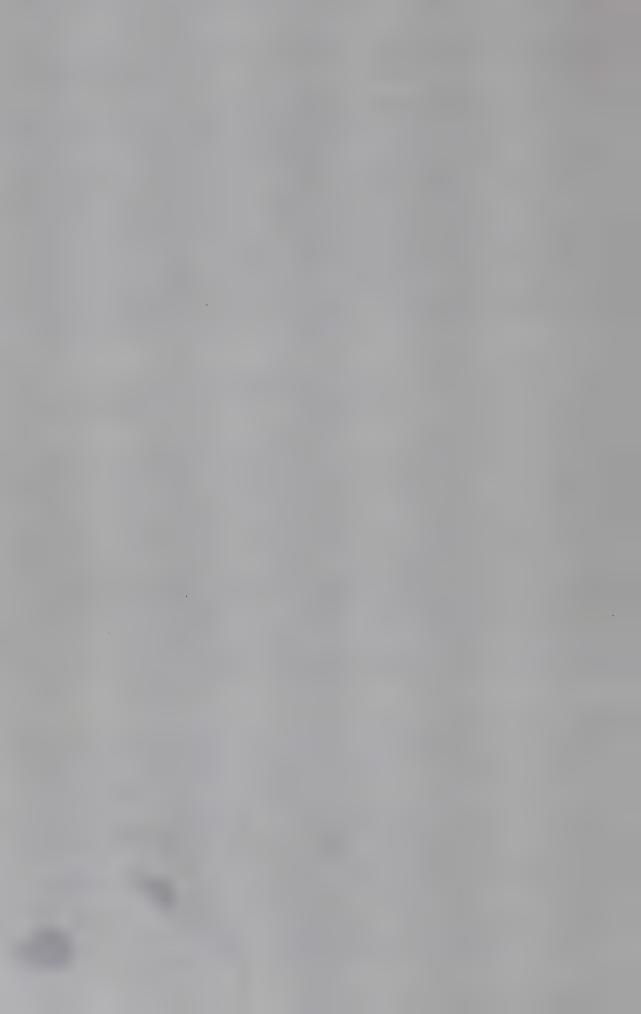
Notes that by using a plastic liner inside an ISO standard freight container for the carriage of liquids, powder and granular materials, instead of individual small packages such as drums, paper sacks, considerable savings in costs can be effected. Such liners can be either one trip or reusable. The advantages of reusable liners are discussed, and materials currently in use for their manufacture are compared; valeron, pvc, polythene can be obtained for £15 to £30, nylon/synthetic rubber at £400, compare favourably with a steel tank of equivalent capacity at £5000. Many liners are presently in use for shipments of malt from Europe to the Far East etc., and for shipment of citrus fruit juice. Mention is also made of intermediate bulk containers, which can be palletised.

ANON. 1975. Formacion de focos de calentamiento en los granos almacenados. (Formation of hot-spots in stored grain. Boln ANDSA, Mexico, 5 (53), 3-4, 1 tabl. (Span.)

Discusses the importance of monitoring temperature fluctuations in stored bulk grain. Notes the natural causes of heating, respiration and germination, and the fact that grain is a poor conductor of heat, thus leading to localised concentrations of heat, or hot-spots. The various factors which influence heating include the activity of insects and microorganisms, the latter especially in damp grain. Notes are given on damage caused by such heating. Insects noted as causing heating are Sitophilus spp., Rhizopertha dominica, Sitotroga cerealella, Oryzaephilus sp. and Cryptolestes, whilst mites can also cause heating. There is a discussion on methods of monitoring temperature in bulk grain, and methods of controlling heating include fumigation to eliminate insects, ventilation and aeration of damp grain, and possibly the use of dryers.

ARDLEY, J.H. 1975. Comparison of two phosphine gas-releasing products for fumigation of infested bulk wheat. <u>Int. Pest Control</u>, <u>17</u> (6), 10, 12-13, 2 tabl, 2 ref. (Author's address: Scientific Adviser, Wellcome Australasia Ltd., P O Box, Concord, 2137, Australia).

Wheat infested by rust-red flour beetle, <u>Tribolium castaneum</u> (Herst) was treated with an application of one Detia Gas-Ex-B sachet containing 34g of aluminium phosphide powder or ten 3g Phostoxin aluminium phosphide tablets per tonne of grain. The recommended application rate is 5g hydrogen phosphide per tonne. In the tests, two levels were employed, an upper one of 8.3g and 8.1g from the respective products, and a lower one of 6.3g and 5.5g of phosphine per tonne of grain. Sieve-samples taken before and after treatment



MYSORE-2A

indicated that the two products were equally effective. The advantage of Gas-Ex-B is that all inert ingredients and residues are retained within the sachet so that its subsequent removal avoids possible contamination of the treated grain.

BARKER, E.J., SHUYLER, H.R., JOBBER, P.I. 1975. A policy and action plan for strengthening national food security in Botswana. Report prepared by a Mission of the Food and Agriculture Organization in cooperation with World Food Programme. iii + 56 + xxi pp, 3 tabl, 9 annex. Rome: UN:FAO (Circulation RESTRICTED to those closely concerned with the programmes analysed, but copies could be made available to individuals in exceptional cases. Technical queries welcomed to be addressed to The Coordinator, Food Security Assistance Programme UN:FAO, Via delle Terme di Caracalla, 00100, Rome, Italy.

Following a request from the Government of Botswana a food security mission organized by FAO visited the country in December 1974 to assess the present and prospective situation, to advise on national food reserve policy and to suggest measures which could be undertaken to implement an effective programme of food security. The past and present food production, trade and aid situation was investigated. Likely future trends were analysed in the context of the country's geographic, climatic and economic position and projected development programmes in these and allied sectors. Objectives have been suggested in relation to food security and a strategy towards attaining them is recommended. The suggestions include needed agricultural development through physical and personnel infrastructure improvements and recommendations are made regarding the establishment of a national food reserve.

BENVINISTI, Y. 1975. Comparison between the moisture content of soybeans and soybean hulls. Inst. Technol. Storage agric. Prod., sci. Activ., 1971-74, 133 (Abstract only). (Author's address: Feed Control Unit, Dept. of Plant Protection, Ministry of Agriculture, Yafo, Israel).

During observations on the spontaneous heating phenomenon of soybeans in storage, a close correlation between the presence of dockage and heating was observed. In order to examine the factors that cause the dockage to play an important role in heating of soybeans, a comparison was made between moisture contents of soybeans and soybean hulls from the same samples. In each sample tested, the moisture content of the hulls was higher than that of the soybeans, thereby indicating that the equilibrium moisture content of the soybean hulls is higher than that of the soybeans.



BINDRA, O.S. and SIDHU, T.S. 1975. Effectiveness of malathion as a protectant for stored maize grain. <u>Pesticides</u>, India, 9 (9), 23-26, 3 tabl, refs. (Author's address: Punjab Agricultural University, Ludhiana, Punjab, India).

Reports on tests using malathion at 20, 30 and 40 ppm on maize artificially infested with newly emerged adults of <u>Sitophilus</u> oryzae and <u>Rhizopertha dominica</u>. Four kinds of storage comprised metal bins, mud bins, Hapur "Chekkas" and gunny bags. Samples were drawn at monthly intervals. It was concluded that a dosage 20 ppm and 40 ppm would give complete protection for 6 and 10 months respectively. Storage in metal bins gave protection over a longer period, but storage in mud bins gave better retention of seed viability.

CARMI, Y. 1975. The residual effects of baythion and malathion on Sitophilus oryzae (L.) in wheat. Inst. Technol. Storage agric. Prod. sci. Activ., 1971-74, 124 (Abstract only). (Author's address: Ministry of Agriculture, Agricultural Research Organisation, Institute for Technology and Storage of Agricultural Products, Bet Dagan, Israel).

Wheat grains of 10.5% m.c. were mixed with baythion and malathion in liquid formulation at an initial dose of 12 ppm to examine their residual effects on S. oryzae. Mortality was examined over a 5-month period by placing adult weevils on the treated wheat samples for 7 days, at monthly intervals after treatment. Baythion produced complete adult mortality over the 5-month period whereas a number of adults remained alive in the malathion-treated wheat, 5 months after treatment. Effects of the treatments on the production of further generations in the wheat were examined by counting adult emergence in the wheat samples 2 months after each monthly test. For baythion, second generation emergence was observed from the adults placed on wheat two months after treatment, but this and subsequent emergence remained low and the second generation adults were all dead. For malathion, second generation emergence was obtained from adults placed on the wheat one month after treatment, though all adults obtained were dead. In the following months emergence increased and some of the adults were alive at the time of examination. The proportion of live insects increased in the subsequent months.



CONNELL, M. 1975. Succession of infestation in illipe nuts in Sarawak, an example of a cash crop problem. Proc. 1st int.

Wkg. Conf. stored Prod. Ent., Savannah, 1974. 30-40, 5 tabl, 11 refs. (Author's address: Australian Wheat Board, G.P.O. Box 4562, Melbourne, Australia).

The oilseed known as illipe nut is a forest product, the fruit of one of a number of Shorea spp., these fruits being collected by subsistence rice growers many of whom practice shifting cultivation. To these people such a crop, requiring only labour input for an early and occasionally generous cash return, is an event of considerable importance. The crop is sporadic in occurence and attracts a variety of insects which cause damage. The uncertainty of the harvest, complex trading arrangements, poor communication between collectors and consumers and difficulty in advising collectors are the main factors which inhibit improvement in hygiene and quality of the product.

DONAHAYE, E. and CALDERON. M. 1975. Laboratory experiments with calcium propionate and propionic acid as fungistatic agents in moist soybeans. Inst. Technol. Storage agric. Prod., sci. Activ., 1971-74, 135 (Abstract only). (Authors' address: Ministry of Agriculture, Agricultural Research Organization, Institute for Technology and Storage of Agricultural Produce, Bet Dagan, Israel).

Soybeans with a moisture content of 15% were treated with calcium propionate and propionic acid, both at two concentrations (0.3% and 0.5%) and then stored for 15 weeks at room conditions in 20-litre containers. Determinations of moisture content, CO₂ concentration, germination and fungal counts carried out at the beginning, during and end of the experiment showed that propionic acid had a greater fungistatic effect than calcium propionate. Germination decreased with both treatments, as well as in the control, but the decrease was greater in the soybeans treated with propionic acid. There were no changes in moisture content throughout the experiment.

DONAYHAYE, E. and CARMI, Y. 1975. Fumigation of dates in packing-houses at Bet She'an and Semakh. Inst. Technol. Storage agric. Prod., sci. Activ., 1971-74, 127-128 (Abstract only). (Author's address: Ministry of Agriculture, Agricultural Research Organization, Institute for Technology and Storage of Agricultural Produce, Bet Dagan, Israel).

In recent years there has been an increase in the export of packed dated, in particular to the United Kingdom. The importing countries require the dates to be completely free of insect pests and this



necessitates rigorous preventative and control measures against stored-date insects in packing houses. Last year information was received that some of the dates reaching England were infected by insects, and the laboratory was requested by the date growers of the Bet She'an and Jordan Valleys and by Agrexco to examine the present state of the packing houses and suggest improvements. Dates in the packing houses undergo a series of treatments, comprising fumigation on reception, cold storage, drying, sorting, repeat fumigation if necessary, and packaging. However, in spite of these treatments some infested dates still enter the final packaging. Since fumigation is the main procedure for insect control in the packing houses, it was decided to carry out a detailed examination of fumigation practice and conditions. The fumigation chambers were examined by carrying out trial fumigations when the chambers were empty and when they were loaded with dates. Sorption by the construction materials of the chambers, leakages from the chamber application, circulation and ventilation system. and gas concentrations in the air space and within the date containers as well as mortalities of test insects were examined in the loaded chambers. The trial fumigations showed that changes are required to reduce leakage and sorption and to provide more uniform concentrations. In addition, different dosage rates and fumigation periods were suggested. Uniformity of fumigation procedure at the different packing houses was suggested and the standard use of ethylene dibromide was proposed, mainly because of its warning cdour as an increased safety factor to the workers. and because of its convenience of application. Suggestions listed in a report to the packing houses on the methods for improving insect prevention and control measures included effective isolation of the fumigated dates from non-fumigated material, and other factors in the packing house liable to permit reinfestation.

DONAHAYE, E. and NAVARRO, S. 1975. Observations on heating of stored cotton seeds in bulk. Inst. Technol. Storage agric. Prod., sci. Activ. 1971-74, 139. (Abstract only). (Authors' address: Ministry of Agriculture, Agricultural Research Organization, Institute for Technology and Storage of Agricultural Produce, Bet Dagan, Israel).

The following observations were made on the heating of cotton seeds in bulk: (a) The temperature of the heating cotton seeds ranged from 62° to 68°C, the highest temperatures being recorded in the upper layers of the heap; (b) The moisture contents of the heating seeds ranged between 2.5 and 3.7%; at the bottom of the heap, moisture contents were between 4.1 and 6.1%. (c) A clear correlation was found between temperatures recorded in different parts of the heap and the extent of browning of the seeds, indicating that the observed hot spot originated from the upper layers of the heap.



FEILLET, P. and ALARY, R. 1975. Etuvage du riz. Influence des conditions de traitements et des facteurs varietaux sur les caracteristique des produits finis. (Rice parboiling: effects of processing conditions and varietal factors on the milled rice characteristics). Annls Technol. agric., 24 (1), 11-23, 5 tabl, 3 fig, refs. (Fr. Eng, Ital, Span. summ). (Authors' address: Laboratoire de Technologie des Bles durs et du Riz, 34060, Montpellier, Cedex, France).

The effects of rice parboiling conditions on the quality of the products were studied using automated laboratory-made equipment. The steeping time (10 or 30 min.) had no influence, whilst a slight increase in the steeping temperature (from 65 to 75°C) lowered the rice consistency after cooking: changes in the steaming time (10, 20 or 30 min.) or in the steaming temperature (105, 112, or 120°C) significantly affected milling yield appearance, yellowing, degree of gelatinization, cooking quality.

HEUSER, S.G. and SCUDAMORE, K.A. 1975. A method for the assessment under standard conditions of the output of dichlorvos slow-release units used for insect control. Analyst, 100, 129-135, 2 tabl, 4 fig, 6 ref. (Authors' address: Ministry of Agriculture, Fisheries and Food, Pest Infestation Control Laboratory, London Road, Slough, Berks. SL3 7HL, England).

A test method is described for the measurement, under standard conditions, of the amount of dichlorvos vapour emitted from insecticide slow-release units. Specimen results, obtained under these conditions, are given for the outputs of several types of unit during the initial 14-day period when output is greatest, with corresponding values for the concentration of dichlorvos in the air in a 28m³ room where constant temperature and humidity are maintained. The relationship between unit output and the concentration developed in the air under various environmental conditions is discussed and the application of the method in the comparative assessment of the potential safety in use of different types of unit is proposed.

KARAKOLTSIDIS, P.S. and CONSTANTINIDES, S.M. 1975. Okra seeds: a new protein source. <u>J. agric. Fd Chem.</u>, <u>23</u> (6), 1204-1207, 4 tabl, 1 fig, refs. (Authors' address: Department of Food and Nutritional Science and Department of Biochemistry, University of Rhode Island, Kingston, Rhode Island 02881, USA).

The seeds of okra (<u>Hibiscus esculentus L.</u>), a common African vegetable now grown in many parts of the world, were tested for the first time for their value as a seed protein. Chemical and nutritional studies were carried out to compare it with other seed proteins such as soya and cottonseed. All determinations were carried out on the



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dried, whole seed. The amino acid content was similar to that of soya beans, and the protein efficiency ratio (PER) was higher in okra. The study indicated that okra seeds meet all the requirements of a rich protein food or feed, and suggestions are made for further investigations into technological, and toxicological problems.

KASHI, K.P. and MUTHU, M. 1975. A mixed indicator strip for phosphine detection. <u>Pestic. Sci.</u>, <u>6</u> (5), 511-514, 3 fig, 6 refs. (Authors' address: Infestation Control and Pesticides Discipline, Central Food Technological Research Institute, Mysore 570013, India).

A rapid, sensitive and reliable mixed indicator paper strip impregnated with dimethyl yellow (0.05%), cresol red (0.1%) and mercuric chloride (1.0%) in methanol, has been developed for the detection of phosphine in air at the permissible level (TLV). The paper strip turns red in the presence of phosphine. It is highly sensitive and has a better shelf-life than indicator strips impregnated with dimethyl yellow plus mercuric chloride, or cresol plus mercuric chloride.

LA HUE, D.W. 1975. Angoumois grain moth: chemical control of infestation in shelled corn. J. econ. Ent., 68 (6), 769-771, 2 tabl, 1 fig, 2 ref. (Author's address: Grain Marketing Research Centre, Agric. Res. Serv., USDA, 1515 College Avenue, Manhattan, KS 66502, USA).

Four candidate protectants for grain were evaluated monthly for 8 months as controls for indigenous infestations of Sitotroga cerealella in shelled maize by counting the number of adult moths that emerged from the bins during a 48 hr period. At the doses applied, pirimiphos methyl, chlorpyrifos-methyl and fenitrothion protectant sprays and a malathion-diatomaceous earth dust gave control and protection equal or superior to that of the recommended treatment of 1.0 pt of 57% malathion e.c./1000 bushels.

LE CATO, G.L. 1975. Red flour beetle: population growth on diets of corn, wheat, rice or shelled peanuts supplemented with eggs or adults of the Indian meal moth. J. econ. Ent., 68 (6), 763-765, 2 tabl, 2 fig, refs. (Author's address: Stored Products Insects Research and Development Laboratory, Agric. Res. Serv., USDA, Savannah GA 31403, USA).

Populations of <u>Tribolium castaneum</u> (Herbst) in maize, wheat, rice and shelled groundnuts increased, and mortality decreased when non-viable eggs or dead adults of <u>Plodia interpunctella</u> were present in the commodity. Such supplement of the diet increased the beetle populations in groundnuts more than in any other commodity



Populations were highest in wheat and groundnuts and lowest in rice. Body weight of the beetles was highest in groundnuts; mortality was highest in rice. The population growth followed a sigmoid curve, increasing slowly initially, then rapidly before levelling off when the environment reached its limit of carrying capacity.

NAVARRO, S. and CALDERON. M. 1975. Effect of oxygen concentrations on <u>Ephestia cautella</u> (Wlk.) pupae exposed to different relative humidities. Inst. Technol. Storage agric. Prod., sci. Activ., 1971-74, 126. (Abstract only). (Authors' address: Ministry of Agriculture, Agricultural Research Organization, Institute for Technology and Storage of Agricultural Products, Bet Dagan, Israel).

E. cautella pupae, 0-24 hr old, were exposed to different oxygen concentrations in combination with different relative humidities. Tests on adult emergence and loss in weight of pupae were carried out at 26 + 1°C. An oxygen concentration of 5.2% caused considerable loss in weight at 21.8% RH, resulting in death of pupae. However, at the same oxygen concentration, when the relative humidity was high, weight loss and mortality were negligible. At oxygen concentrations lower than 1.3% and at 95% RH, although loss in weight was low, a high mortality rate was recorded. Calculations showed that the low critical weight loss threshold ranges between 29 and 34% of the pupal weight.

NWANZE, K.F., PARTIDA, G.J. and McGAUHEY, W.H. 1975. Susceptibility of <u>Cadra cautella</u> and <u>Plodia interpunctella</u> to <u>Bacillus thuringiensis on wheat. J. econ. ent., 68 (6), 751-752, 1 tabl, refs. (Authors' address: Dept. of Entomology, Kansas State University, Manhattan 66506, USA).</u>

Doses of 25 and 105 mg/kg of <u>Bacillus</u> thuringiensis applied as distilled water suspension controlled first instar and mature larvae, respectively of <u>P. interpunctella</u> and <u>Ephestia cautella</u> in wheat. No difference in susceptibility measured by adult emergence was observed between the two species. It is suggested that a pest management programme using <u>B. thuringiensis</u> together with a compatible grain protectant such as gamma BHC could help reduce pest populations.



OSUJI, F.N.C. 1975. The effects of salt treatment of fish on the developmental biology of <u>Dermestes maculatus</u> (Coleoptera, Dermestidae) and <u>Necrobia rufipes</u> (Cleridae). <u>Entomologia exp. appl.</u>, <u>18</u> (4), 472-479, 5 tabl, 2 fig, refs. (Author's address: Department of Zoology, University of Ibadan, Ibadan, Nigeria).

Fish meal containing various levels of common salt concentration from 3.18% to 10.20% was used to investigate the effects of salt on the developmental biology of D. maculatus and N. rufipes.

Larval development of both beetles was prolonged in salted fish and larval mortality was total in D. maculatus at salt concentrations of 9.20% and 10.20%. Salting resulted in decreased larval and adult body weight, reduced fecundity and egg viability. The results are discussed in relation to fish processing in Nigeria.

OVERHULTS, D.G., WHITE, G.M., HAMILTON, H.E., ROSS, I.J. and FOX, J.D. 1975. Effect of heated air drying on soya bean oil quality. Trans. Am Soc. agric. Engnrs, 18 (5), 942-945, 1 tabl, 4 fig, 9 refs. (Authors' address: Agricultural Engineering Department, University of Kentucky, Lexington, Kentucky, USA).

Soya beans at 20, 23 and 33% m.c. were dried at temperatures of 100, 160 and 220°F. Oil was extracted from each sample and its quality compared with that of a control sample. Oxygen was excluded from contact with the beans and oil except during the drying process. The results indicated that some oxidation of the oil occurred but that the overall quality was not seriously affected. However, because of the oxidative deterioration, the storage life of the beans may have been decreased substantially. Both temperature and initial moisture content had significant effects on oil quality. Since increased moisture content increases the time required for drying, the initial moisture effect is probably masked by the time of exposure to a given temperature. Beans dried at higher temperatures gave a greater oil yield, indicating a breakdown in the physical structure which might contribute to a decreased storage life for the dried product.

PILTZ, H. von. 1975. Entomologische Beobachtungen an der Landung der beiden Hamburger "Bitterseeschiffe". (Entomological investigations in ships held for eight years in the Great Bitter Lake). Anz. Schadlingsk., 48 (11), 167-169, 6 refs. (Author's address: Dr H Piltz, Inst. f. Angewandte Botanik der Universität Hamburg, Abt. Amtliche Pflanzenschau, 2 Hamburg, 11, Versmaunstrasse 4, West Germany).

The holds of two ships which had been held for eight years in the Great Bitter Lake of the Suez Canal were inspected and fumigated



after their return to Hamburg. The commodities, mostly different kinds of feedingstuffs, were found to be infested by insects which are not commonly detected in large numbers in goods from the same countries of origin (India and Pakistan) after a normal period of transport. They included Attagenus gloriosae, Gibbium psylloides and Anthrenus flavipes.

SEIFERT, R.M., BUTTERY, R.G. and GUADAGNI, D.G. 1975. Volatile components of jute sacks. J. Sci. Fd Agric., 26 (12), 1839-1845, 3 tabl, 2 fig. (Authors' address: Western Regional Research Laboratory, Agricultural Research Service, US Department of Agriculture, Berkeley, California 94710, USA).

The vacuum steam volatile oil from new jute sacks imported from Calcutta was subjected to detailed analysis. Thirty-four compounds were identified with some certainty, and some information was obtained about an additional thirty-six. The odour thresholds of some of these compounds were determined. These data, and calculations of the amount of the various compounds transferred to a food contained in a sack whilst in store, indicate that a jute sack can contribute an off-flavour or odour to the food.

SINHA, R.N. and CAMPBELL, A. 1975. Energy loss in stored grain by pest infestation. <u>Canada Agric.</u>, Spring 1975, 3 pp, 5 illus. (Authors' address: Agriculture Canada Research Station, Winnipeg, Manitoba, Canada).

Discusses the need for a universally acceptable criterion for the measurement of losses in stored grain. Reports briefly on studies of calorific loss of energy caused by two stored product pests, the granary weevil (Sitophilus granarius) and the flat grain beetle (Cryptolestes ferrugineus). It was found that although the energy consumed by Cryptolestes individuals is only approximately one fourteenth of that consumed by Sitophilus individuals the much higher reproductive rate of the former results in high total losses. The study demonstrated that measurement of energy loss of wheat kernels by insect infestation can be quantified in calorie values. Further work is proposed in the hope that the information obtained will provide an accurate indication of the actual and potential commercial loss of stored grain caused by stored product insects.

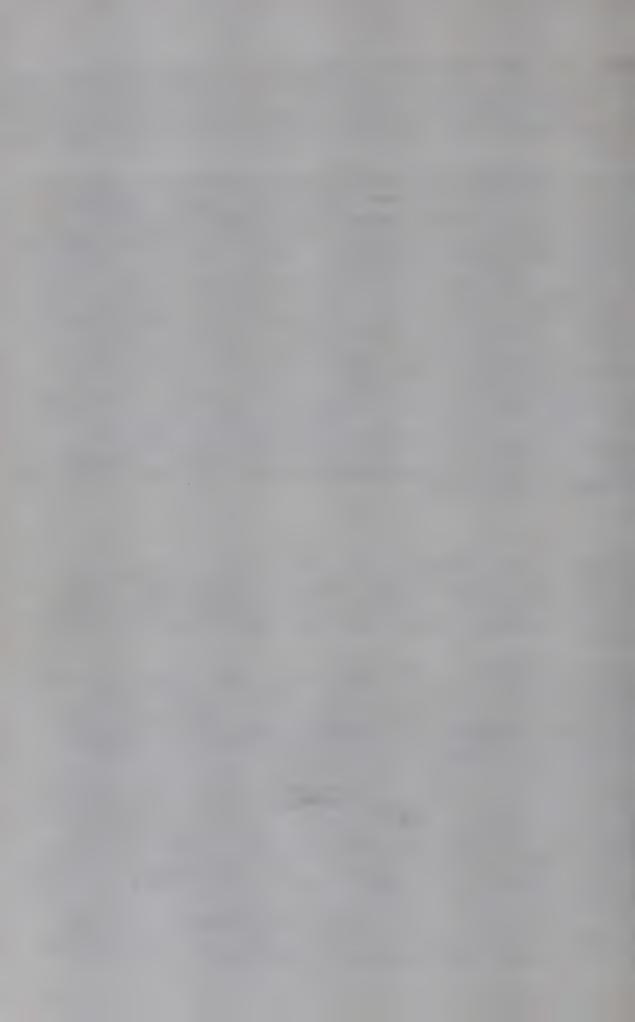


SMITH, L.L. 1975. Aeration of cottonseed in storage. Mktg Res. Rep., U.S. Dept. Agric., No 1020, 42 pp, 30 fig, append. (Author's address: U.S. Cotton Ginning Research Laboratory, Southern Region, Agricultural Research Service, U.S. Department of Agriculture, Stoneville, Miss., U.S.A.).

Discusses problems associated with quality maintenance and germination of stored bulk cottonseed. Reports on studies of factors relating to seed moisture content and storage temperatures. Preliminary observations were made to determine the effectiveness of currently used systems of aeration. Uneven air distribution and high static pressures in the systems contributed to poor storage conditions. By moving relatively small amounts of atmospheric air through stored cottonseed, heat developed during ginning can be removed, so minimising or preventing mould growth. Aeration can, in most cases, effectively remove any hot spots resulting from excessive moisture or other causes. Cooling stored conttonseed to a temperature of 50 to 60°F can help to prevent ffa increase and maintain seed viability. Engineering information is given which provides for the design and installation of efficient aeration systems for all common styles of cottonseed storages. Sample calculations for equipment selection and system design are included in the appendix.

SPITUER, G.H. and HARTSELL, P.L. 1975. Pirimiphos-methyl as a protectant for stored in-shell almonds. <u>J. econ. Ent.</u>, <u>68</u> (6), 777-780, 2 tabl, refs. (Authors' address: Stored Product Insects Research Laboratory, Agric. Res. Serv., USDA, Fresno, CA 93727, U.S.A.).

Sprays of pirimiphos methyl, applied to inshell almonds at rates calculated to give deposits of 1.6, 3.6, 6.8 and 16.1 ppm, protected the nuts from insect damage for 1 year. Test insects were Plodia interpunctella, Tribolium castaneum, T. confusum, Oryzaephilus surinamensis and O. mercator. After 12 months storage residues on whole nuts were 0.43, 1.3, 2.0 and 3.6 ppm respectively. The 3 highest dosages gave excellent protection (less than 2% damage) throughout the period. The lowest dosage gave good protection (less than 20% damage) for 10 months but thereafter test samples contained increasing numbers of live insects although damage increase was small. Residues on the nutmeats of the pirimiphos methyl after 30 days in storage and 1 year later were respectively 0.25 - 0.16, 0.42 - 0.47, 0.75 - 1.00, and 1.40 - 1.80 ppm. In 3 of the insecticide treatments, a slight increase in the residues indicates the ability of the pirimiphos methyl to migrate from the shells to the nutmeats.



STOREY, C.L. 1975. Mortality of three stored product moths in atmospheres produced by an exothermic inert atmosphere generator. J. econ. Ent. 68 (6), 736-738, 1 tabl, refs. (Author's address: U.S. Grain Marketing Research Centre, Agric. Res. Serv., USDA, Manhattan, Kansas 66502, U.S.A.).

The order of tolerance to an atmosphere of less than 1% oxygen (at 27°C and 50% RH), produced by an exothermic inert atmosphere generator was studied for Sitotroga cerealella, Ephestia (Cadra) cautella and Plodia interpunctella. Results, in descending order of tolerance were: larvae/pupae - eggs - adults; eggs - pupae - larvae - adults; and pupae - eggs - adults - larvae, respectively. All stages of P. interpunctella and all except the eggs of E. cautella were killed by 24 hr exposures. Eggs of E. cautella required a 48 hr exposure. The tolerance of S. cerealella larvae to the inert atmosphere increased with each successive week of growth after the eggs hatched and the larvae entered the kernels. An exposure of 120 hr was required to cause 100% mortality of fully grown larvae and pupae.

TERIAKI, A. and VERNER, 1975. List of stored product mites and insects in Syria. Sb. Vys. Sk. zemed. Praze, Fak. agron., A, 307-320, 2 tabl, refs. (Engl, Engl, Czech, Arab, Russ. summ.). (Author's address: Department of Plant Protection, Agricultural University, Prague - Suchdol and Czech Academy of Agriculture, Research Institute of Food Industry, Prague 5, Czechoslovakia).

Reports on a survey carried out in 1972. Sixteen samples comprising wheat, barley, wheat sweepings, dried vegetables, dried capsicum, dried camomile, cottonseed, cottonseed bran and beans were collected in three localities in Syria: Aleppo, Rakka and Latakia. Examination of the samples disclosed 32 species associated with stored products, including 7 spp mites, 1 pseudoscorpion, 21 spp Coleoptera, 1 sp. Lepidoptera, 2 spp Hymenoptera. The dominant spp were Tribolium castaneum (Herbst), Sitophilus oryzae (L.), S. granarius (L.), Rhizopertha dominica (F.) and T. confusum J. du Val.



welcomed, to be addressed to The Coordinator, Food Security Assistance Programme, UN:FAO, Via delle Terme di Caracalla, 00100 Rome, Italy).

This report is based on the findings of an FAO Mission established in accordance with the terms of the International Undertaking on World Food Security, and was prepared in response to a request from the Government of the Philippines for assistance in formulating policies for national food security. An assessment is made of the current foodgrains situation, problems and prospects. Proposals are made for a medium-term food security strategy, and for immediate action to strengthen national food security. Emphasis is placed on the need for producer incentives, an effective intelligence system covering supply and predicted demand and a strong comprehensive planning process. No new construction of storage facilities for proposed paddy reserves is considered necessary; the present capacity is thought to be adequate, provided good sound paddy is stored under trained, experienced supervisors. There are recommendations for the provision of dryers to handle increased production; the necessity for external financial support is recognised, and some estimated costings are given.

UNITED NATIONS: FOOD AND AGRICULTURE ORGANIZATION 1975. Marketing and storage development project, Uganda. Quality control programme. Based on the work of C G Van Teeling. AG: DP/UGA/71/513, Tech. Rep. 1, vi + 50 pp, 5 refs, 17 append (UN: FAO, Distribution and Sales Section, Via delle Terme di Caracalla, 00100 Rome, Italy).

The Government of Uganda with assistance from the United Nations Development Programme and FAO, is implementing a project designed to strengthen the operations of the Produce Marketing Board. An important part of this programme was concerned with produce quality improvement. A Quality Control Section was set up consisting of a physical grading unit and a chemical analysis unit. Data were collected to define Uganda produce quality for each of 32 controlled crops, and based on these data, grading standards were recommended. The analysis of export produce was emphasised to ensure maximum return to the Board. Procedures were recommended in all aspects of quality control. Plans were drawn up for the Board's new Central Storage Depot and expanded quality control facilities consisting of grading services at each depot with a chemical laboratory in the Kampala depot. Recommendations are made for future operation of the Quality Control Section and for step by step introduction of grading standards in the Uganda marketing system.









